



# LINUX

THE COMPLETE MAGAZINE ON OPEN SOURCE

VOLUME: 06 ISSUE: 11 January 2009 116 PAGES

ISSUE# 72

**ForYou**

# fedora 10

## fire it up!

### An Effortless Upgrade

...but is it really worth it?

### Fedora Localisation Project

80 languages, and there's room for more...

### Fedora India

Sneak-peek into India-based community

### PackageKit

A distribution-neutral software manager

### Vulnerability Assessment

Get started with OpenVAS

### How Secure is a WEP Key

Hah! I can crack it within minutes

### Network Troubleshooting

Some handy tools to get the job done

### Python Scripts

for your home network

### Graph Your Network

Cacti makes it oh-so-easy!

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### Exclusive Interviews

Paul Fields, Fedora Project Leader  
& Max Spevack of Community Arch team



**Life as an administrator  
Is complicated enough...**

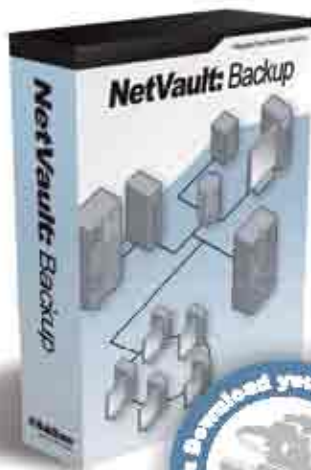
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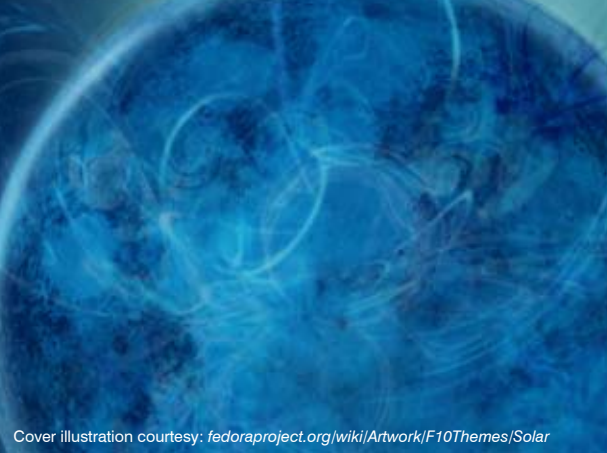
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Cover illustration courtesy: [fedoraproject.org/wiki/Artwork/F10Themes/Solar](http://fedoraproject.org/wiki/Artwork/F10Themes/Solar)

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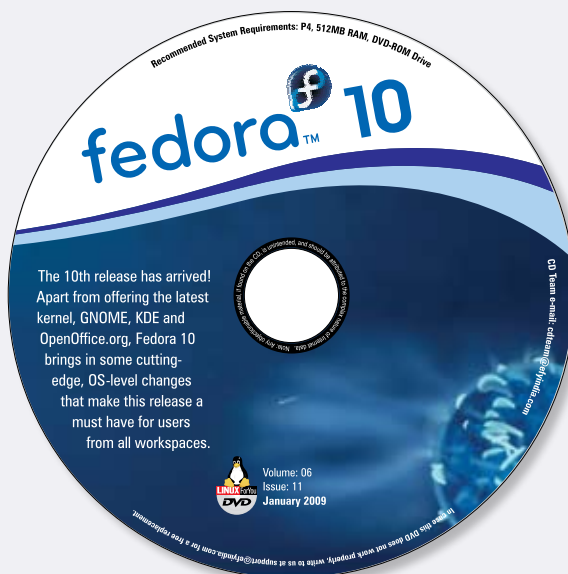
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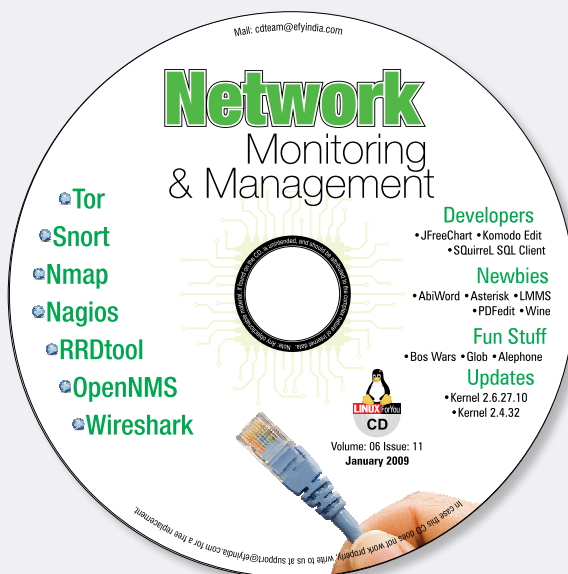
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## LFY CD



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# EDITORIAL

Dear Readers,

First, let me wish you all a Very Happy New Year on behalf of the entire *LINUX For You* team.

To start off this year with a BIG BANG, we have for you the distro that many of our readers keep asking for—Fedora's latest release! Along with it comes a brief review of Fedora 10, interviews with Fedora's project leader, Paul Frields, and Max Spevack (the guy who heads the community architecture team), a feature on Fedora's Indian community, and more.

For those of you who are into IT management, there's an additional bonanza—our issue theme focused on network monitoring and management. Apart from the latest editions of the top FOSS solutions related to this theme that have been packed onto the *LFY* CD, we also have four articles that should empower you to manage IT better.

Every time we approach the New Year, the buzz at *LINUX For You* increases—all thanks to Open Source India (a.k.a. LinuxAsia). Yes, it's time for us to start finalising the speakers' list and push sponsors to fund the event. Thankfully, some inroads have already been made this year.

The 2009 edition of OSI is going to be held at Chennai from 12th to 14<sup>th</sup> March. The venue is the Chennai Trade Centre, and the event is titled 'Open Source India *Tech Days*', which we believe best symbolises the heightened focus on the content and the target audience of this edition. Our primary audience is going to be IT managers and software developers. But plans are being finalised to reach out to newbies too.

It is to be our first time in Chennai, but going by the response we have received so far from our readers and open source followers in the region, it seems OSI *Tech Days* is going to be an event that will be remembered for all the right reasons.

Since 2003, when this event was launched as LinuxAsia, our mission has been to create a platform that enables an increase in the development and adoption of open source in India, and in Asia.

We invite your views and support to achieve that mission.

Best wishes!



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# You said it...



Thanks for the article on libraries. Some of them are really helpful—it helps me to understand the importance of some coding -- for example, extern 'C'.

—Vineesh Kumar, by e-mail to Nilesch Govande, on his article on Libraries published on Page 66 in the December 2008 issue



First of all, thanks for this wonderful article—it really helped me a lot. I am new to the C programming language and my question may seem pretty naive but some help would be really great. When you described the process of writing *main.c* for a dynamic library, you showed it with different APIs.

My question is: When we call *printf()* in the normal way in, say, *example.c*, even then it is dynamically linked. Am I right? But in that case we just call it *printf()*, with no use of APIs. Can you please spare a few moments of your time to explain the difference, or suggest some reading material so I can equip myself with sufficient knowledge before proceeding?

—Himanshu Mall, by e-mail to Nilesch Govande on his article on Libraries

**Nilesch replies:** To answer your question on whether when *printf()* is called the normal way, is it even then dynamically linked...you are absolutely right, it is. In fact, *printf()* being part of *libc* will always get linked dynamically unless you specify -static at compile time. When you wrote, "But then there we just call it

*printf(); no use of APIs," did you mean to say APIs like *dlopen()* and *dlsym()*?*

*We need to do these acrobatics because we are linking a non-standard C library and the symbol address of the 'display' function is not known to the compiler. Since *glibc* is present with the compiler itself, the address resolution is not required. Going further, if you were able to build the 'display' executable in the dynamic library section, try:*

```
[root@localhost dynamic]# nm -u display
U dlclose@@GLIBC_2.0
U dlerror@@GLIBC_2.0
U dlopen@@GLIBC_2.1
U dlsym@@GLIBC_2.0
U exit@@GLIBC_2.0
U fprintf@@GLIBC_2.0
w __gmon_start__
w __Jv_RegisterClasses
U __libc_start_main@@GLIBC_2.0
```

*So the functions *dlopen()*, *dlsym()*, etc, are present in your *libc* itself. Even:*

```
/******a.c*****/
#include <stdio.h>
int main()
{
    printf("Hello!!!!\n");
    return 0;
}
#gcc a.c
#./a.out
Hello!!!!
```

*Hence, even the linking of *glibc* is invisible to us. But if you really want to view it, try:*

```
#gcc -v a.c
```

*Now, notice the output!*



I'm studying in the 10th standard and want to enhance my knowledge of Linux. Thanks for making me a Linux geek. I've been a

regular reader of the magazine since August 2008.

I'm currently using Ubuntu Ultimate and I've a request: can you include Ubuntu Ultimate 2009 and Mandriva Powerpack 2009 in the *LFY* DVD? As an Ubuntu fan, I'm very passionate about Ubuntu Ultimate and also Mandriva. Since I don't have broadband connectivity, I can't download these images.

—Sarith Mohan, by e-mail

**ED:** It's great to know that *LFY* is helping you in your journey with Linux :) Mandriva 'Free' 2009 was bundled with the November issue. Check it out! The Mandriva Powerpack editions are not freely distributable. As for the Ubuntu Ultimate edition, it was released after our Ubuntu multi-boot DVD was packed. So, we couldn't bundle it. Let's hope they release the Ultimate edition on time for v9.04. We'll surely try to bundle it then.

## Errata

Misprints in December 2008 issue:

- Pg 37: In column 1, first paragraph, the spelling of Kasargod was spelled as Kazargode.
- Pg 37: Anoop John's name was misspelled as Anoop Johnson
- Pg 37: It was a 44-day long Freedom Walk, and not 43 days long as printed.
- Pg 88: In column 2, the second command snippet reads *create table session; use session;* It should have read *create database session; use session;*
- Pg 89: In column 2, source code for login.php reads:  

```
$con=mysql_connect('127.0.0.1','root','sivasi
va') or die(mysql_error());
mysql_select_db('session',$con) or
die(mysql_error());
```

It should have read:  

```
$con=mysql_connect('127.0.0.1','user','pass'
) or die(mysql_error());
mysql_select_db('session',$con) or
die(mysql_error());
```

Please send your comments or suggestions to:

## The Editor

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# TECHNOLOGY NEWS



## openSUSE 11.1 eliminates the EULA

The openSUSE project has released version 11.1 of its operating system with significant enhancements to desktop productivity, entertainment applications, and software and systems management. The new version was entirely developed using the recently released openSUSE Build Service 1.0, a collaboration system that enables contributors to work closely together on Linux packages or solution stacks. Updates to openSUSE 11.1 include: kernel 2.6.27.7, which adds support for a number of new devices and improved video camera support; remote desktop experience with Nomad; improvements to YaST that includes an improved partitioner, new printer module, and a new module to check system security; latest versions of major applications

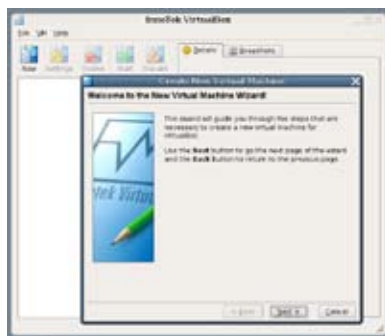
including Firefox 3.0.4, OpenOffice.org 3.0, GNOME 2.24.1, KDE 4.1.3 and KDE 3.5.10 and Mono 2.0.1; further improvements to software management through improvements to the *zypper/libzypp* utilities; and much more.

Additionally, this release also brings in a simpler licence that eliminates the EULA and removes software that previously made it difficult to redistribute openSUSE. Version 11.1 can be freely downloaded now at [www.opensuse.org](http://www.opensuse.org).

## 3D graphics acceleration and bridged-networking with VirtualBox 2.1

Sun Microsystems has announced a new version of Sun xVM VirtualBox desktop virtualisation software. Sun claims that users of version 2.1 will benefit from significant improvements in graphics and network performance, easier configuration, hardware platform support for the latest processors and additional interoperability.

The new version boasts of accelerated 3D graphics, improved network performance that makes network intensive applications like rich media faster and finally introduces bridged networking configurations, and comes with built-in iSCSI support to connect to storage systems. In addition, xVM VirtualBox 2.1 software offers improved support for VMware's and Microsoft's virtualisation formats and enables support for the new Intel Core micro-architecture in the Intel Core i7 processor (codenamed Nehalem). It also allows users to run a powerful 64-bit guest OS on 32-bit host platforms without the need to upgrade the host OS, while taking advantage of multi-thread applications on powerful hardware. xVM VirtualBox software is available free of charge from the VirtualBox.org.



## MySQL 5.1 simplifies management of large-scale database apps

Designed to improve performance and simplify the management of large-scale database applications, the production-ready MySQL 5.1 has been released. MySQL 5.1 features a number of new enterprise-class enhancements, including table and index partitioning, row-based and hybrid replication, an event scheduler, along with a new MySQL Query Analyser.

MySQL 5.1 is available now for a wide variety of hardware and software platforms, including Red Hat Enterprise Linux, SuSE Enterprise Linux Server, Microsoft Windows, Solaris 10 Operating System (OS), Macintosh OS X, Free BSD, HP-UX, IBM AIX, IBM i5/OS and other popular Linux distributions. For downloads and more information on MySQL 5.1, go to [dev.mysql.com/downloads](http://dev.mysql.com/downloads).

## BBC iPlayer comes to Linux

The British Broadcasting Corporation (BBC) and Adobe Systems have announced the public beta of the new BBC iPlayer Desktop download manager built on Adobe AIR. The new BBC iPlayer Desktop beta will enable Linux (and also Mac) users to download programmes to their desktops. Previously, the ability to download programmes was only available to Windows users. The new download manager allows users to view their favourite BBC shows, online or offline. The BBC iPlayer Desktop beta also integrates Adobe Flash Rights Management Server software for content protection.

The BBC iPlayer Desktop application on Adobe AIR will be available to BBC iPlayer Labs users, who can sign up at [www.bbc.co.uk/iplayer/labs](http://www.bbc.co.uk/iplayer/labs). It will be rolled out to all users during 2009.



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# TECHNOLOGY NEWS



## Python 3.0 is now intentionally backwards incompatible

Python developers have released the final version of Python 3.0 (also called Python 3000 or Py3k), a major reworking of the programming language that is incompatible with the Python 2 series. The language is mostly the same, but many details, especially how built-in objects like dictionaries and strings work, have changed considerably, and a lot of deprecated features have finally been removed.



Also, the standard library has been reorganised in a few prominent places, developers said.

In a document outlining the changes, Guido van Rossum, creator, Python, said, "Nevertheless, after digesting the changes, you'll find that Python really hasn't changed all that much—by and large, we're mostly fixing well-known annoyances and warts, and removing a lot of old cruft."

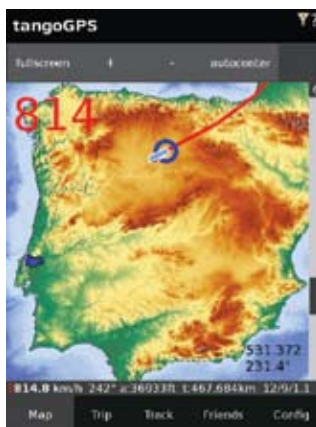
The *print* statement has been replaced with a *print()* function, with keyword arguments to replace most of the special syntax of the old print statement (PEP 3105).

Another major change is that Unicode will now be the default. Python 3.0 uses the concepts of text and (binary) data instead of Unicode strings and 8-bit strings. All text is Unicode; however encoded Unicode is represented as binary data. The type used to hold text is *str*, the type used to hold data is *bytes*. The biggest difference with the 2.x situation is that any attempt to mix text and data in Python 3.0 raises *TypeError*, whereas if you were to mix Unicode and 8-bit strings in Python 2.x, it would work if the 8-bit string happened to contain only 7-bit (ASCII) bytes, but you would get *UnicodeDecodeError* if it contained non-ASCII values.

## Hackable:1, a new distro for hackable devices

A new distribution for the Neo and other hackable devices dubbed Hackable:1 has been released. Based on the DebianOnFreerunner, it packages the OM2007.2 applications, extending and bug-fixing them. It is intended to become a stable platform for the VAR market and is fun to use for everybody else. Some of the highlights include: OM2007.2 packaged as *.deb* packages that include the dialler, SMS, contacts, neod, phone-kit, gsmd, matchbox and panel applets; improved sound quality (fixes for gsmd for echo cancellation); extended AUX and power menus; simple onscreen keyboard with all hacker characters on a short press on the AUX button; GPS works out of the box; many GPRS providers preconfigured for easy use; and GSM multiplexing preconfigured (that is, you can have calls and SMSs coming in during a GPRS session).

The distro comes as a tarball and you can download it from [www.hackable1.org/hackable1/?C=M;O=D](http://www.hackable1.org/hackable1/?C=M;O=D). In order to get started, you'll require a 2 GB SD card and a card reader for your PC/laptop. Partition and format the SD card, and then simply untar the tarball onto it. Your Flash even remains untouched, so you can easily give it a test run. For more information, check out [www.hackable1.org](http://www.hackable1.org).



## Movial Octopus: A central point of contact for all multimedia requirements

Movial has announced it is contributing the Movial Octopus Media Engine, the multimedia enabling source code, to the mobile Linux community. Octopus uses the OpenMAX standard and enables easy integration of multimedia into different mobile applications.

The Movial Octopus Media Engine controls audio and video content that can be read from local files or streamed over the network. Octopus provides a higher-level API for end-user applications to manage multimedia content. Target applications include media players as well as voice and video call applications for devices such as MIDlets and Netbooks. Octopus works as a background service that several applications can use simultaneously. For media content operations, such as video calls, Internet streaming and MP3 playback, Octopus uses either GStreamer or OpenMAX IL components. Developers can download Octopus at [sandbox.movial.com/wiki/index.php/Octopus](http://sandbox.movial.com/wiki/index.php/Octopus). The current client API is a D-Bus API and plans are underway to offer an OpenMAX AL API in 2009.

## Novell's new PlateSpin supports leading hypervisors

Novell has enhanced its PlateSpin Workload Management solution. The new PlateSpin Recon, PlateSpin Migrate, PlateSpin Protect and PlateSpin Orchestrate enable users to profile, migrate, protect and manage server workloads between physical and virtual infrastructures in heterogeneous IT environments. PlateSpin Workload Management, according to the company, is the only solution on the market today to support 32- and 64-bit Linux and Windows servers, as well as all leading hypervisors.





# TECHNOLOGY NEWS

## Adobe announces Linux Version of AIR 1.5

Adobe has released Adobe AIR 1.5 for Linux. Adobe AIR 1.5, a key component of the Adobe Flash Platform, enables Web developers to use HTML, JavaScript, ActionScript and the free, open source Flex framework to deliver Web applications outside the browser.

AIR 1.5 includes functionality introduced in Flash Player 10, such as support for custom filters and effects, native 3D transformation and animation, and extensible rich text layout. Offering new features and performance improvements to create more expressive AIR applications, version 1.5 incorporates the WebKit HTML engine, and now accelerates application performance with 'SquirrelFish', the new WebKit JavaScript interpreter. Version 1.5 also includes a new, encrypted database that meets enterprise security compliance requirements while storing data more securely on customers' computers.

AIR 1.5 is available as a free download at [get.adobe.com/air](http://get.adobe.com/air). The Adobe AIR 1.5 for Linux software development kit is also available for free: [www.adobe.com/products/air/tools/sdk](http://www.adobe.com/products/air/tools/sdk).

## Hybrid: a cost-cutting open/proprietary approach

netCORE has come up with an innovative concept called 'Hybrid Messaging Environment'. This is an integration of netCORE's Linux-based Mailing Solution (EMS) with the existing MS Exchange/Lotus server.

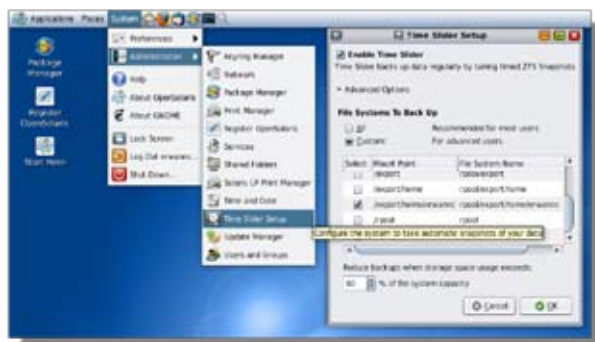
Hybrid Messaging Solution supports a Linux-friendly messaging environment and enables full Outlook functionality. Enterprises can scale their e-mail systems and choose the most economical storage components, while the servers can communicate on a peer-to-peer basis with Exchange and the rest of the e-mail ecosystem.

## New OpenSolaris unveils Time Slider visualisation tool

The OpenSolaris community has announced the release of OpenSolaris 2008.11. New features in OpenSolaris include Time Slider, an easy to use graphical interface that brings powerful ZFS functions like instant snapshots, to all users. Developers also have expanded access to repositories allowing them to get innovations out to all OpenSolaris users through the updated package manager.

In addition to performance gains, this latest version makes it easier for companies to deploy OpenSolaris solutions within their data centres. These enhancements include a new Automated Installer application, allowing users to decide which packages to include within the installation Web service; the Distro Constructor that enables users to create their own custom image for deployment across their systems; and a new storage feature called COMSTAR Storage Framework that allows developers to create an open storage server with OpenSolaris.

A few highlights of the enhanced OS are support for improved overall system performance by taking advantage of Intel Quick Path Interconnect, better scalability with Intel Hyper-Threading technology, and virtualisation with support for Intel Virtualisation Technology. For more information, visit [www.opensolaris.com](http://www.opensolaris.com)



## Ingres rolls out Ingres Database 9.2

Ingres Corporation has announced the availability of Ingres Database 9.2, an open source database that helps organisations develop and manage business-critical applications at an affordable cost. Ingres Database 9.2, according to the company, copes with even the most complex, multi-language requirements including business intelligence, content management, data warehousing, enterprise resource planning (ERP) and logistics management.

This database is engineered to keep your Ingres-based solutions up and available around the clock, and is claimed to be the only open source database that combines the flexibility of open source with the business-critical availability and reliability of commercial database management system platforms.

Ingres Database 9.2 is said to reduce the time, complexity, and database administration (DBA) requirements by simplifying and automating many tasks traditionally associated with maintaining a business-class database. Upgrades from previous releases are a simple, highly automated task with no requirement to reload data. In addition, the release focuses on improved application development, with enhanced availability and supportability.

The database provides multi-language support with expanded Unicode features. The new features focus on increasing the availability of the server, such as enhancements to point-in-time restore and online backup. Visit [esd.ingres.com/product/Ingres\\_Database/9.2](http://esd.ingres.com/product/Ingres_Database/9.2) to download Ingres Database 9.2.





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## Vision Statement of Open Source India

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- Development of Open Source software
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## Key Industry Verticals Being Targeted

- IT Firms (Software Development)
- ITeS Firms (BPO, KPO, etc)
- Banking & Finance (BFSI)
- Manufacturing
- Research and Development Labs
- Education (Government and Private Institutions)
- Government

## Size of firms being Targeted

- SME (Small & Medium Enterprise)
- Enterprise

## Schedule of Events

Three days plus four halls allow us to try and discuss many topics and reach out to a variety of audience. Here's a list of events that have been finalized till date:

### Software Developers' Track

- 12<sup>th</sup> March: FOSS-enabled software development
- 13<sup>th</sup> March: FOSS-powered Mobile phones (and devices)

### IT Managers' Track

- 12<sup>th</sup> March: FOSS Tools for IT Managers
- 13<sup>th</sup> March: Cloud Computing, Virtualization and SaaS

### .INFO Track

- 12<sup>th</sup> March: FOSS-powered eGovernance
- 13<sup>th</sup> March: FOSS for education (Half-day)
- 14<sup>th</sup> March: FOSS-powered desktops (Half-day)

### Other Events

- 12<sup>th</sup> March 2009: IOSN Asia Summit
- 12<sup>th</sup> March: Industry Demos (Half-day)
- 13<sup>th</sup> March: Industry Demos (Half-day)



# KNOW HOW



**Q I am using Mandriva 2009 on my laptop. How can I check my runlevel and also the services that are running on my system?**

—Shiv Prasad, by e-mail

A. Use command *runlevel* or *who -r* to check which your current runlevel is. You can use the *chkconfig* command to check which processes are scheduled to run on which run level. Please read man pages for these commands to know more.

**Q I am a student and a regular reader of LINUX For You. I have a computer in my room which is shared by my room mates. They often change the root password of my computer. I know that by applying password to my GRUB I can restrict them from doing so. Can you please let me know how I can set a password for GRUB, which I have not done during my OS installation. I am using Fedora. Do I need to reinstall it?**

—Jophie Thomas, Mangalore

A. Not at all! You do not need to reinstall OS just to apply a password to GRUB. Here are the steps that will help you out. Open terminal and log in as root. Now type *grub* at the root prompt. Use the *md5crypt* command to encrypt password as follows:

```
grub> md5crypt
Password: *****
Encrypted: $1$6kdFq$sy6oqBCUMPa.wEK95.
J8S/
```

Copy this encrypted password and exit grub mode by typing *quit* at the *grub>* prompt.

Now open the */etc/grub.conf* file in a text editor and add the following in the global section of the config file:

```
password --md5 $1$6kdFq$sy6oqBCUMPa.
wEK95.J8S/
```

Save the edited file and restart your computer. Try entering single user mode and see the Grub prompt you for a password now.

**Q I am a subscriber of LFY since its inception, and enjoy the content and distribution packages provided. I am trying to install the Tata Indicom USB stick modem on my P-III processor desktop with Mandriva 2007.**

However, during a modem query in KPPP, it first gives a message that modem is detected, and then as the status bar shows progress, a message window appears with a message “Query timed out”, and the process terminates.

Can you please let me know how this can be installed? Also, this distribution does not have the *wvdial* package and a guideline is required as to how this can be obtained.

—A.K.Das, Jamshedpur

You can try to install *wvdial* from the Mandriva DVD. In case you don't have the DVD media handy, you can refer to [easyurpmi.zarb.org/old](http://easyurpmi.zarb.org/old) and follow the steps to configure the online software repository. Once

you're done, execute the following command as root:

```
urpmi wvdial
```

After installing it you can configure the */etc/wvdial.conf* file as given below, but first, remember to check your *dmesg* to confirm your modem settings. In case your computer does not recognise your device as modem, then check the *dmesg* for the ‘Product ID’ and ‘Vendor ID’ of the card. Once you know these IDs, *modprobe* for the driver by running the following command as root:

```
modprobe usbserial vendor=0x<vendor id
here> product=0x<product id here>
```

Now run the following command to create */etc/wvdial.conf*:


```
wvdialconf /etc/wvdial.conf
```

Open the */etc/wvdial.conf* file in a text editor and add the following to it:

```
[Modem0]
Modem = /dev/ttyUSB0
Baud = 115200
SetVolume = 0
Dial Command = ATDT
Init1 = ATZ
FlowControl = Hardware (CRTSCTS)
[Dialer tata]
Username = <your username>
Password = <your password>
Phone = #777
Stupid Mode = 1
Inherits = Modem0
```

Now run *wvdial* as follows:

```
wvdial tata
```

Hope this helps and you are able to connect to the Internet. **END** 



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# Director's Cut Let's Roll Out A DVD Movie

Whoever said producing DVD movies on Linux is a no-no, should think again!

*I* am an unabashedly proud owner of a MacBook and I was taken aback at how easy it was to create and edit a home video DVD on it. Being a downright fan of GNU/Linux, however, the first impulse I had was to replicate the experience on Fedora, a GNU/Linux flavour that I am terribly attached to and have come to swear by over the last few years.

This article is my attempt at sharing some of my findings with you. I don't know if these are the best possible techniques, but I am sure that they work. I have also tried to write this article so that one could use any

part of the home video DVD creation process without having to go through all the others. I will also try to point out alternatives and references on the Web that might contain more information on these alternatives.

A user of intermediate proficiency with GNU/Linux would very easily be able to follow the steps listed below. Novices can surely follow, but might require a little patience.

## Breakdown

Here are the steps that you would roughly need to follow to get your home video DVD that can be played back on a standalone DVD player:

- Import your video footage from your camera
- Edit, arrange and beautify (add music, special effects, etc) your video footage
- Convert your work into DVD compatible video
- Create a layout (menus) for your DVD
- Burn your DVD

Let me mention at the outset that following the guidelines in this article might turn out easier on Fedora than on other GNU/Linux distros, but definitely won't be impossible. For Fedora users, the Livna repository (which has recently been merged with RPMFusion) will be very handy, and you should first add the repository by clicking on all the right places at [rpmfusion.org/Configuration](http://rpmfusion.org/Configuration). Add both the free and non-free repositories.

Once this is done, you can install any required software for your home DVD with *Yum*.

## Importing video footage

The way to import video footage would depend largely on the equipment that you have. If you use a digital (still) camera to capture your video, then the process is as simple as attaching your camera to your Linux box via a USB cable and copying the files off it. Personally, I use a card reader.

If you use a tape-based video camera, which is a little dated (like the one I have), then you are probably going to need some extra hardware on your machine. I have a very cheap PCI TV card on my machine that, apart from having the RF input for the TV signal, also has a Composite and an S-Video input. These are just different standards for analogue video, and S-Video is supposed to give somewhat better video quality than Composite. For most of us, the difference will be imperceptible.

Using an appropriate cable, connect the output of your video camera to the input of your TV card. At this point you are ready to transfer the footage to your

hard disk. I use *mencoder*, brother of MPlayer, and in my mind an underrated and underused piece of software. You should definitely have these two gems installed on your machine. Do that with:

```
yum -y install mplayer mencoder
```

You are probably going to have *Yum* install a whole lot of other dependencies with it as well, so don't panic!

Now there are two ways in which we could use *mencoder* to import the video. One would be to import using real-time encoding to some popular video format like Xvid, or we could import raw footage, that is, unencoded video format. An encoding algorithm would, of course, take much less space than raw footage, but it would also result in some loss of quality.

I prefer to import raw video and work on it. That's because we will eventually have to encode the edited movie to the particular format that DVD video uses, and encoding twice will result in quality that you might not be too happy with. However, you could also just take the video you have shot and convert it into an encoded format like Xvid without any editing. (This could be done if you have a DVD player that also supports DivX file formats and you are sure that you don't have any unnecessary footage—or also if you are plain lazy!)

Here are a couple of variations on the same theme. Both of these would grab video coming from the TV card and encode it on-the-fly to a specified format.

```
mencoder -of avi -tv driver=v4l:\
input=1:device=/dev/video0:forceaudio:\
norm=NTSC:width=640:height=480 \
-ovc lavc -lavcopts vcodec=mpeg4:\
vbitrate=2000 -oac mp3lame -lameopts cbr:\
br=224 -o output.avi tv://
```

```
mencoder -of avi -tv driver=v4l:input=1:\
device=/dev/video0:forceaudio:norm=PAL:\
width=640:height=480 -ovc xvid -xvidencopts \
```

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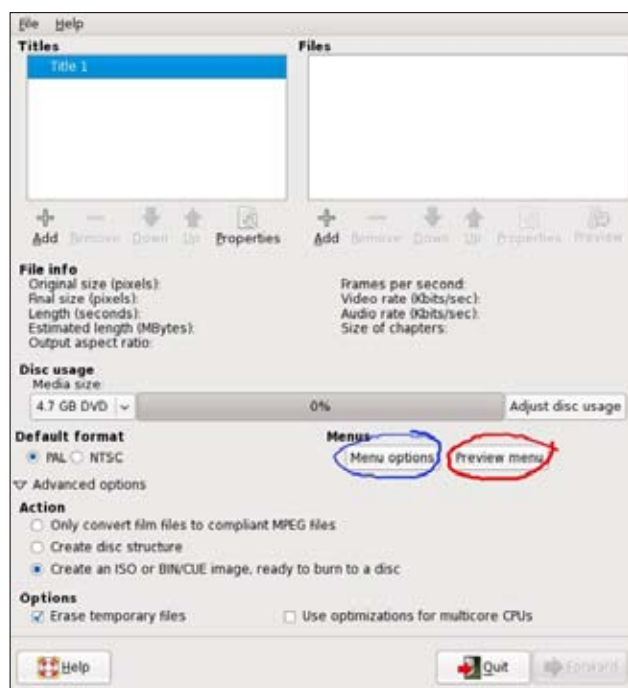


Figure 1: The main DeVeDe window

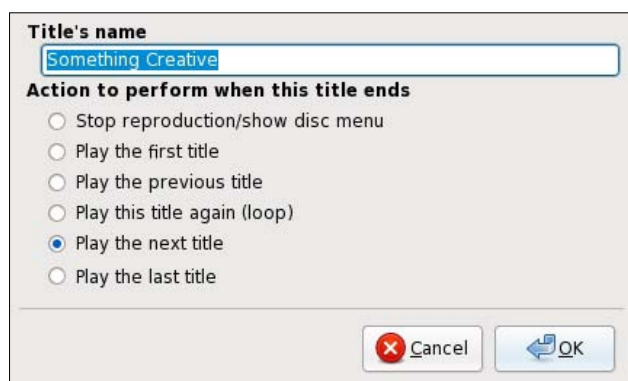


Figure 2: Title properties

```
pass=2:bitrate=300 -oac mp3lame -lameopts \
cbr:br=224:mode=3 -o output.avi tv://
```

More information on the parameters used here can, of course, be obtained by *man mencoder*, but here is a breakdown of the essentials:

- *-of avi* specifies the output file format to be an audio-video interleave (a *.avi* file basically)
- *norm* specifies your camcorder/TV card output standard (mine can be changed)
- *-ovc* defines the type of video encoding to be used (the first uses *lavc* and the second *xvid*)
- *-oac* defines the output audio format (*mp3* in both cases)
- *-o* specifies the output file name

You might need to change some settings depending on your software set-up. For example, you might try *driver=v4l2* if it is supported on your system. Your input device might be different from */dev/video0* (unlikely

though). *input=1* specifies the Composite input on my TV card (that's where I connect the video camera). *mode=3* specifies the same (mono) output to be routed to both the output channels—don't use that if you have a stereo output coming in; use it if you find sound coming out of one speaker only when you play back your output file. *vbtrate* and *bitrate* are the video bitrates and a higher value for either would provide better quality at the cost of a bigger output file. *tv://* is to instruct mencoder to take the input from the TV card.

I suggest you experiment a little with short captures (let's say between 10 and 20 seconds; you need to press *Ctrl+C* to stop the encoding) with different parameters, to see and decide for yourself what works for you before jumping headlong into a big project. You can quickly play back the short clip with *mplayer <outputfilename>*.

But as I mentioned, I like working with raw video, so I use:

```
mencoder -of avi -tv driver=v4l:input=1:\
device=/dev/video0:forceaudio:\
norm=PAL:width=640:height=480 \
-ovc copy -oac copy -o output.avi tv://
```

Be warned that this will take up an abnormal amount of disk space because this does a raw dump of both audio and video streams. If disk space is at a premium, it would serve you well to use the *lavc* option (given above) with a higher *vbtrate* so that you have a decent trade-off between hard disk usage and quality.

You'll have to run one of these commands and simultaneously play back the tape on your camcorder. After that you should have your output file on your hard disk. This will be your raw footage. If you are uncomfortable with one large file you can manually pause the camcorder from time to time and start encoding in a different file.

## Editing and arranging footage

This really is a part of the DVD creation process that cannot be taught. How you go about this step would depend on your personal aesthetics and sense of artistry. Crisp editing will do wonders for any movie—I guarantee that from personal experience.

What is more pertinent for this article is the software that you could use to do your video magic. There are a number of choices available, but I like *Kino* (that's because it is in many ways similar to *iMovie* on the Mac). Again, Fedora users can just install *Kino* with:

```
yum install kino
```

For my favourite tutorial you can view [www.yourmachines.org/tutorials/kino.html](http://www.yourmachines.org/tutorials/kino.html). It will teach you everything that you need to know, including how to add titling to your movie (for credits, etc), how to add black video to segregate various portions of your footage, how

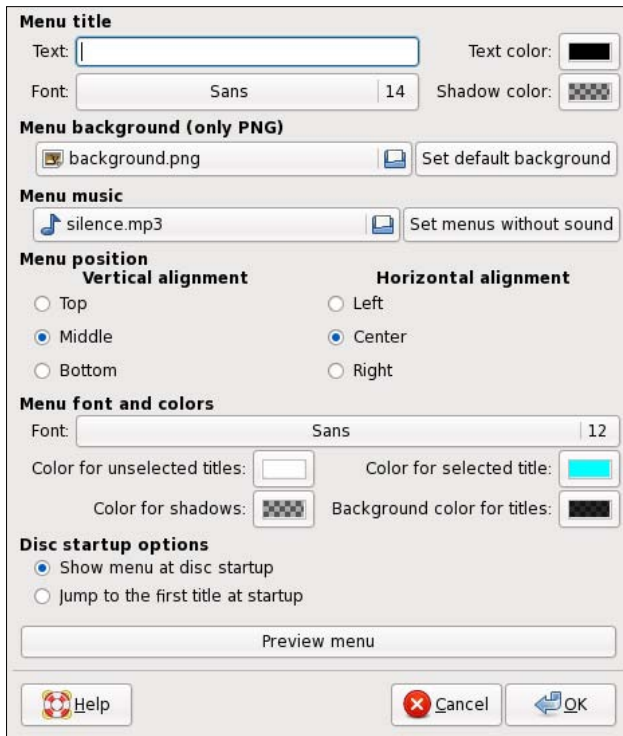


Figure 3: Menu options

to add transitions, and how to trim your clips to discard unnecessary video footage, amongst various other techniques.

With Kino, you might get a little lost when you have finished editing and want to export your final movie. To export your work, go to the **Export** tab (the lowest tab on the extreme right hand column of the *Kino* window) and go to the **DV File** tab. Right above this tab, make changes so that it reads *“Every 1 frame of All”*, otherwise you'll end up exporting a single clip instead of the entire movie. And keep the **Raw DV** selected.

## Converting output into DVD video

DVD video has its own specific audio and video formats. Before you can create a DVD that you can view on a standalone player or on your computer software, you need to encode your finished project to this format.

For this you need to use the following commands:

```
mencoder -oac lavc -ovc lavc -of mpeg -mpegopts \
format=dvd -vf scale=720:576,harddup -srate 48000 \
-af lavcresample=48000 -lavcopts \
vcodec=mpeg2video:vrc_buf_size=1835:\
vrc_maxrate=9800:vbitrate=5000:keyint=15:\
aspect=4/3:acodec=ac3:abitrage=192 \
-ofps 25 -o output.mpg input.format
```

If you want output for the widescreen format, you'll have to change the *aspect* to 16/9 instead of 4/3. *input.format* refers to the output file from *Kino*. (Remember the *.dv* file that you exported?)



Figure 4: An example menu

You might also just want to make a VCD from your home movie. (Maybe it's a short movie or you are a little stingy with DVDs!) Like DVDs, VCDs also have their own specific encoding. You'll have to use the following:

```
mencoder -oac lavc -ovc lavc -of mpeg -mpegopts \
format=xvcd -vf scale=352:288,harddup -srate 44100 \
-af lavcresample=44100 -lavcopts vcodec=mpeg1video:\
keyint=15:vrc_buf_size=327:vrc_minrate=1152:\
vbitrate=1152:vrc_maxrate=1152:acodec=mp2:\
abitrage=224:aspect=4/3 -ofps 25 -o output.mpg input.format
```

If you are a little more technically inclined, I'll urge you to study the commands for the DVD and VCD formats by yourself. It does not matter how little you understand—it'll be a start.

## DVD cosmetic design

If you've done everything well till now, you should be in a position to create a DVD disc. By this I refer to the menus that you often see on DVDs with which you can navigate to see different features on the disc. You would want to have a DVD menu when you are burning more than one home video to a DVD disc, or if you have a particularly long video project (like a family marriage) and want to split it up into the various days it was spread over. Be warned however, that this splitting up would need to be done in *Kino*; that is, instead of exporting one large file depicting the entire event, you would need to export a few smaller files.

For the DVD disc creation we would be using a small but power-packed member of the FOSS world, namely DeVeDe. The following command should do the trick:

```
yum install deveDe
```

I should probably mention at this point that DVDStyler

is also a good choice and may suit those more artistically oriented. But in its present avatar, it is a nightmare to install on Fedora 9/10. Ubuntu users will probably have a better time as [www.dvdstyler.de](http://www.dvdstyler.de) provides *.deb* packages. But back to DeVeDe...

Once you start up DeVeDe, you will be asked about what kind of disc you want to create. Answer 'DVD Video' to that. You will be presented with a screen that looks like what is shown in Figure 1.

In the box (on the left hand side), which says *Titles*, for fun and games, press the *Add* button three or four times. Each time you will find a new title appearing. When you are done clicking, press the *Preview Menu* button (circled in red). What you see will be the first look of what your DVD menu could look like. You will see a background picture and a number of titles corresponding to the number of times that you clicked the *Add* button earlier. Press *OK*.

Of course, the menu right now is incapable of doing anything. You would have to associate your DVD video files with it and surely you would want to name those titles a little more descriptively than *Title 1*, *Title 2*, etc.

To change the default title names, select the title that you want to change and click on the *Properties* button. You will see Figure 2. Change the name to whatever you want to and associate an action with this title by selecting a corresponding option. For a really great touch, you can harness the power of GNU/Linux to write the titles in your mother tongue. I do my titling and credits in Bangla whenever I can.

To make changes to the global menu layout, press the *Menu Options* button (circled in blue). You will then see Figure 3. I could explain what everything here does, but it would be better if you experiment for yourself. Make a change and hit the *Preview Menu* button at the bottom of the window to see what the DVD menu now looks like. You can also have a selected sound file playing in the background when your menu is displayed. Professional stuff! Figure 4 is an example of a DVD menu that could be created.

Now, you would need to associate the video file you want to play when each title is selected. Go back to the window in Figure 1. Select the title you want to associate a video with and press the *Add* button under the *Files* box (which is adjacent to the *Titles* box). Select your video file. Go and click the little triangle beside *Advanced Options*, go to the *Misc* tab and select the checkbox which says "This file is already a DVD/xCD-suitable MPEG-PS file". We are going to do this because we have already used *mencoder* to convert our edited video footage to DVD compatible video.

Once you are done allotting video files to all your titles, you are ready to create the DVD ISO. Click the *Forward* button in the window from Figure 1. You will be asked for a place to store the DVD image. Please heed the warning of not saving to a FAT32 partition. A

FAT32 cannot store any file over 4 GB (a DVD image can be as large as 4.3 GB) and all kinds of horrible things will happen. (*Lesson: Avoid anything even remotely connected to the Windows world :-)*)

When DeVeDe is finished with the process you will find an ISO with whatever name you selected, saved at whatever directory you chose. (I am assuming that you have kept the default options from Figure 1.)

## Burn, baby burn!

You are a step away from sweeping friends and family off their feet. Fire up K3b. If it is not already on your system, Yum is your best friend. Select *Tools*→*Burn DVD ISO Image...*

The rest is easy. You can play back this DVD on a standalone player.

## Afterthoughts

Before I leave you with dreams of your movie, let me point out some things that you could explore further.


Kino is capable of Firewire capture, so if you have a Firewire port and a similarly enabled video camera, you could get your footage straight from your camera to Kino.

DVD compatible video can be created through Kino and DeVeDe as well. I'll leave that exercise to you, if you haven't noticed it already. In essence, it uses *mencoder* commands in the background that are very similar to the ones that I have written about. In addition, DeVeDe can encode to XviD as well.

DeVeDe also allows you to create a VCD, as does K3b. While DeVeDe can encode to VCD compatible video, you'll have to manually do the encoding for K3b with *mencoder* from the command line. In *K3b*, select *Further Actions...* in the *Quickstart* tab you can select *New Video CD Project*.

DVDStyler allows you to customise your menu item graphics and also allows you to place them anywhere on the DVD menu screen.

I am hoping that this article will take you a step closer to completely shifting to GNU/Linux. For the last eight years, I have had no OS but Fedora on my desktop. And I am an average (but dedicated) GNU/Linux user.

Last but not least, while I have done some experimentation, I have learnt about a lot of the material presented here from sources on the Web. I am afraid I cannot acknowledge everyone because I keep all these commands in a text file in my home directory, and have no idea where I collected them from. But rest assured, it wouldn't have been possible without the great Open Source Community. 

**By: Anurup Mitra**

The author is a long-time Fedora fan(atic) and GNU/Linux lover and wants to see Linux on every computer in India. He works for STMicroelectronics and divides his time between designing circuits for them and teaching at BITS Pilani. He can be reached at [anurup.mitra@gmail.com](mailto:anurup.mitra@gmail.com)



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# fedora 10

## An Effortless Upgrade

...but is it really worth it?

These days, it is very difficult to highlight the visible and noticeable changes in a distribution. As it is, there is a reluctance to upgrade in case some working application breaks down. In the absence of anything striking, a reasonable position can be, "Why bother?" If the cost of upgrading is low, more people may upgrade. Hence, aside from the noticeable differences, we will discuss a couple of lesser-known techniques to upgrade Fedora with less effort.

### What's different?

Can a user tell that the machine is now upgraded? Of course—the boot up screen is different. There is a nice colourful progress bar as the system boots. Then, the default wallpaper is different. After that, the usage is about the same as before. My personal view is that not noticing a change is an advantage. There will be no need for retraining. That said, here are some of my observations:

1. Fedora 9 introduced KDE4 and it caused a lot of problems for KDE3 users. Once KDE4.1 came, I actually switched from being a predominantly GNOME user to a predominantly KDE user. I liked the sparse desktop. I liked the Dolphin file manager, particularly the split mode and the terminal panel within Dolphin. I got used to the new menu system. Fedora 10 continues with the enhancements in KDE4. The change most noticeable for me was in the Amarok player. It left me confused. I can play the music but at times can't figure out whether I have found a bug or haven't learnt how to use Amarok! I suppose I will get used to the new interface and the additional capabilities, or switch to Rhythmbox!
2. The other major change is in OpenOffice.org. Fedora 10 now includes version 3.0. An OpenOffice.org 2 user will be perfectly at ease with the new version. While I was writing this article, the KDE desktop started behaving oddly. Although OpenOffice.org worked perfectly fine, the KDE menus and the clock widget did not get displayed properly when using the proprietary Nvidia driver (not supported by Fedora). But the display was fine if the AIGLX option was off and the composite option was disabled. However, on GNOME, even with the desktop effects enabled, the behaviour was as expected.
3. The login page of GDM includes a form to set convenient universal access features. Being able to increase the text size with a simple click will be especially convenient for older users. As on Fedora 9, GDM still has a bug of not recognising *xdmcp* connections. A patch is available on the forums, but the patched version is not yet available from the repositories. As is common on Linux, a bug is not a major bottleneck. We can use KDM instead.
4. Switching to the new Plymouth system initialisation system did not make a noticeable impact on the booting time on my desktops (from power-on to the login page). I suspect that the speed up may be noticeable if there are lots of services that are started, and more savings may come if the kernel does not have to rediscover all the devices and reconfigure the hardware every time it boots. A gain of the new booting process is that diagnosing start up problems on Debian-based distributions and Fedora will now be similar. It all starts with */etc/event.d/rcS*. I am reminded of a comment in a mainframe code: "This is where you start, where you end up is your problem!"

## Kidstuff

The Fedora 10 repository now includes Sugar, the learning software environment for the OLPC project. As yet, only a few activities are packaged in RPMs. I expect that more will be added as time passes. The Fedora project team hopes to get more people actively involved in the Sugar project by making the platform accessible to a wider population. I would strongly recommend that you try the *turtleart* activity, based on Logo. It is a colourful, fun way to learn programming.

## RPMFusion

In addition to the Fedora 10 release, the availability of RPMFusion repositories has been extremely valuable. The confusion between whether to use Livna or FreshRPM's is over. The migration has been transparent for all those who were using either of these two repositories and conflicts between the packages have been ironed out.

## Pre-upgrade

The pre-upgrade utility has become very useful with Fedora10. The idea is that it will analyse the packages that are installed and download the required upgrades while you continue working. The utility will also ensure that dependencies are not destroyed for the packages that have been installed from alternate repositories. This is the first time I did not have to do anything to ensure that the multimedia functions worked for the various formats, even after the upgrade. The steps involved are as follows:

```
# yum install preupgrade
# preupgrade
```

On my system, it downloaded 1.8 GB of packages in 24 hours. If you stop in the middle, it restarts from where it left off. Once the packages are downloaded, reboot the system and it will install the upgrade.

The upgrade failed once. It needed about 1.5 GB of free space. I could boot normally, create the desired space and run *preupgrade* again. This time, the upgrade was uneventful.

This step took a little over two hours. So, the effective downtime was two hours. A fresh install will be faster, but will need all the settings to be redone and the additional packages to be downloaded.

The migration to Fedora 10 was effortless. Everything worked fine after the upgrade, including MPlayer, VLC, and MP3 playback. After that, I used *yum update* to upgrade the multimedia packages.

## Using update to upgrade

It is possible to update Fedora 10 with virtually zero downtime using an unsupported process. I had first come across [www.ioncannon.net/linux/68/upgrading-from-fc6-to-fedora7-with-yum](http://www.ioncannon.net/linux/68/upgrading-from-fc6-to-fedora7-with-yum) last year and used this technique for upgrading from Fedora 7 to 8 and then from 8 to 9. On both occasions, I had a few problems with some multimedia packages. This time, the process was remarkably smooth thanks to the availability of

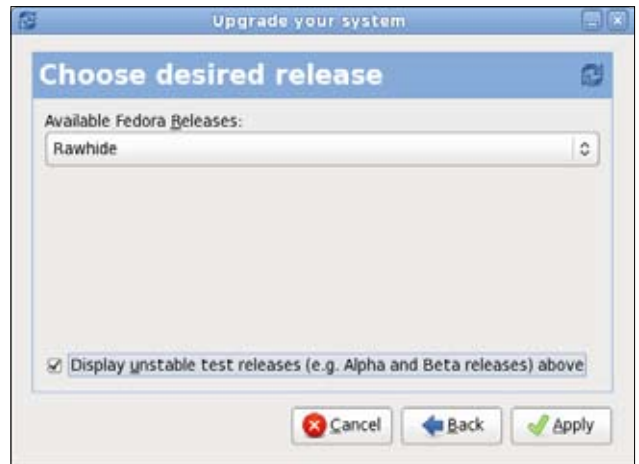


Figure 1: Select an available update, observe and reboot when ready



Figure 2: The KDE 4.2 desktop with an instance of Miro running

RPMFusion repositories as well. The steps involved are:

1. Download the following packages from the Fedora 10 repository:  
`fedora-release-10-1.noarch.rpm`  
`fedora-release-notes-10.0.0-1.noarch.rpm`  
`yum-3.2.20-3.fc10.noarch.rpm`
2. Use *rpm -U* to update the above three packages
3. Clean the existing repositories using *yum clean all*
4. Finally, run *yum update*

The fourth step will take a very long time to first download the packages. On my parents' system, it needed to download 1.2 GB and took about 18 hours. The update went on in the background for over two hours. As libraries and packages get replaced, some applications may present a problem, but I did not face any. I wasn't doing anything serious—just playing music and browsing.

If an installation DVD is available (like the one bundled with this month's *LFY*), copy the RPMs into the `/var/cache/yum/fedora/packages` after Step 3, and the update will download only the missing or updated packages.

I find this method very useful for small networks. The cache directory can be shared over the network and the *keepcache* option can be set to 1 in *yum.conf*.



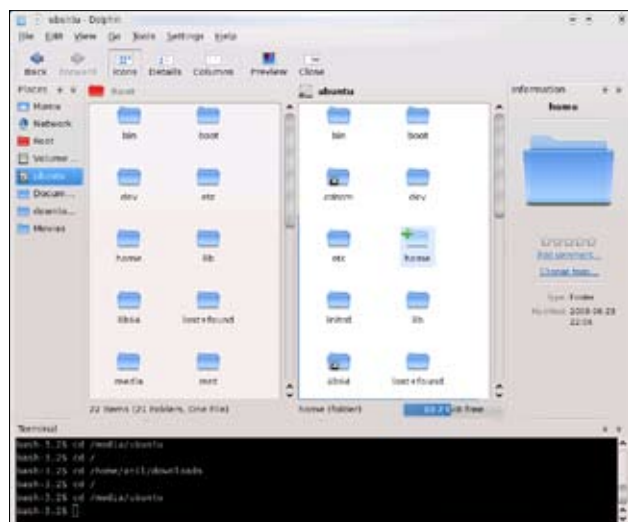


Figure 3: Dolphin with split window and terminal panel



Figure 4: Turtle Activity in Sugar

This is much easier than mirroring a repository locally. Only the packages required by at least one machine are downloaded, only when needed.

## Disappointments

1. I am disappointed that Presto and Delta RPMs did not become a part of the Fedora 10 repositories. These will have to wait till Fedora 11. The Fedora 10 Delta RPMs are available for i386 using the Yum repository setting `baseurl=http://lesloueizeh.com/f10/i386/updates` in `fedora-updates.repo`. For the first update, I needed to download only 21 MB instead of the 111 MB if the full RPMs were downloaded. At the time of writing, Delta RPMs were not available for x86\_64. See [fedorahosted.org/presto](http://fedorahosted.org/presto) for the current status.
2. Once in a while, when the system checks a disk at boot time, the boot-up delay can be long, but there is no feedback on the GUI to the users, asking them to be patient.
3. The Intel display driver caused a machine (three years old) to hang. The problem is with kernel 2.6.27 and not with

Fedora 10, per se. I faced a similar problem on Fedora 9 and Ubuntu 8.10 as well. The workaround is to add the following option in the device section of `xorg.conf`:

Option "NoAccel" "True"


4. The other disappointment has nothing to do with Fedora. The list of mirrors selected for India points to countries around us—Taiwan, Japan, Russia, etc. I needed to change the mirror list manually to point to the US servers for better, more consistent performance. My disappointment is that no Indian ISP is mirroring the common distributions even though the ISP would save on substantial international bandwidth. The couple of Indian mirrors available do not have adequate bandwidth and, in my experience, have normally been inaccessible.

## Wish list

1. I would like to see Delta RPM support even for upgrading a distribution.
2. I would like PulseAudio server to just work even on remote desktops. The default setting of the `PULSE_SERVER` variable should be picked up from the `DISPLAY` variable.
3. I would like to see Firefox 3.1 available on Fedora 10 and not have to wait for Fedora 11.
4. I would like to see GNOME 2.6 included in Fedora 10, with an option to roll back to 2.4, if I so desire.
5. Actually, I would like to be able to upgrade my installation continuously and not ever face another new version. (More on that in *LINUX For You*, April 2008; PDF version available in the magazine section of the *LFYCD*.)

## Recommendations

1. The new versions of distributions contain very little that is substantially different from earlier versions. Most of the packages are minor upgrades, with improvements and security fixes. The major issues with a distribution are resolved very quickly and it does not make sense to wait months or years for the distribution to be stable!
2. It is easier to work with OpenOffice.org 3 on Fedora 10 than to install and maintain it on your own on a lower version.
3. An upgrade is like an insurance policy. If I need to work with a recent application, the chances are that I would find it in the latest distributions. For example, it is much easier to explore the Sugar environment on Fedora 10 than on the earlier distributions.
4. Finally, upgrading a distribution keeps getting easier and less prone to problems with add-on packages.

Hence, should you upgrade? A reasonable position is, "Why not!" **END** 

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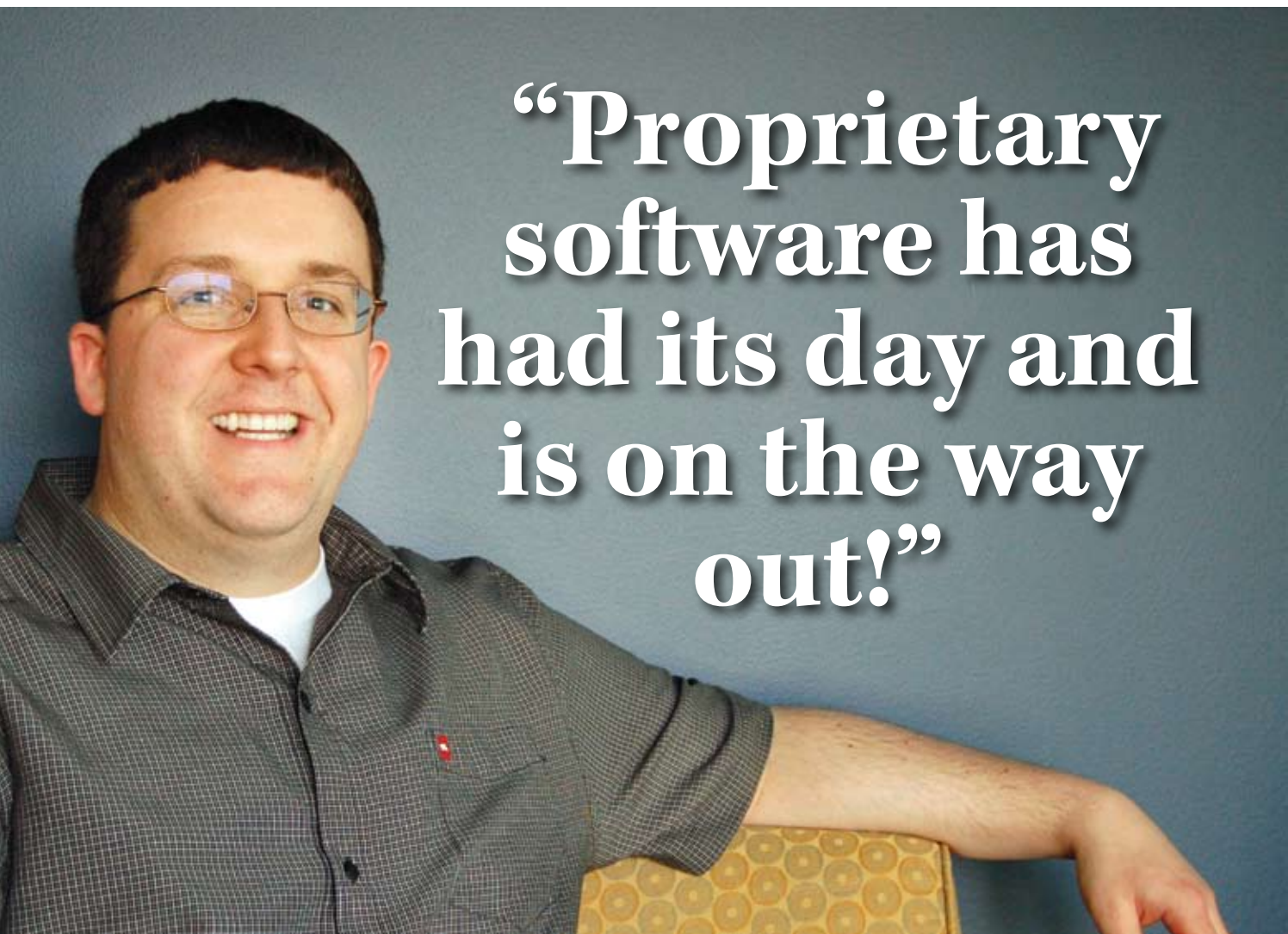


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# “Proprietary software has had its day and is on the way out!”

**Paul W. Frields** has been a Linux user and enthusiast since 1997, and joined the Fedora Documentation Project in 2003, shortly after the launch of Fedora. As contributing writer, editor, and a founding member of the Documentation Project steering committee, Paul has worked on guides and tutorials, website publishing and toolchain development. He also maintains a number of packages in the Fedora repository. In February 2008, Paul joined Red Hat as the Fedora Project Leader. Naturally, on the occasion of the 10th release of Fedora, we decided we needed the Project Leader's insight into what goes inside the project. So, here's Paul for you...

**Q How and when did you realise that FOSS was something you were really interested in?**

I had been using FOSS professionally for a few years as a forensic examiner. Then I started teaching it to others as a means of both saving taxpayer money, and producing results that could be independently verified, since the code was open and available to anyone. Also, if there were problems, frequently we could discover the reasons behind them and resolve them ourselves. I was really fascinated with the idea that all

this great software was produced by people who, in many cases, hadn't ever met in real life, collaborating over networks simply in pursuit of better code.

**Q So what is your opinion on proprietary software?**

Proprietary software is probably only useful in very niche cases—cases where the overall body of knowledge about whatever the software does is very rare or hard to obtain. For general-purpose uses, proprietary software has really had its day and is on



the way out. The idea of paying for personal information management software, database services or word processing is pretty antiquated.

**Q You've been in systems administration in previous work places, are an active documentation writer/contributor, and also maintain a few packages yourself. Can you explain a bit about each of these roles, and whether you'd rather call yourself a writer, a developer or a systems administrator?**

Actually, I wasn't ever really a true systems administrator. I did some work that bordered on sys admin work, but really, I was more of a dabbler. That having been said, I did get to touch upon a lot of different technology areas, from scripting and clustering, to building customised kernels and distros. I also spent a lot of time documenting what I did for other people, and teaching them hands-on. So I think the term 'dabbler' is probably best—Jack of all trades and master of none!

**Q How did you get associated with the Fedora Project?**

I started with Slackware but used Red Hat Linux starting with 4.1, all the way up until Red Hat Linux 9 was released. I didn't watch project schedules that much or subscribe to a lot of lists, so I didn't know about the Fedora Project until the fall of 2003. I was delighted to have a chance to contribute back to a community that had helped me build my skills, knowledge and career. I decided to get involved with documentation because I wasn't really a software developer, but I was a decent writer.

**Q What's your role as the Fedora Project Leader?**

The Fedora Project Leader is much like the Fedora Project's CEO. Ultimately, I'm accountable for everything that happens in Fedora. Red Hat pays me to make sure that the Project continues to fulfil its mission as a research and development lab for both the company and the community, and that we are consistently moving forward in our mission to advance free and open source software worldwide.

**Q Among Fedora Project contributors are those who are RH employees, and there are those who work as volunteers. How do you ensure there's minimal clash of interests? For example, what if there's a significant difference of opinion on the direction Fedora should be headed towards?**

To minimise the chances of this happening, we have a well-defined governance structure. For example, we have a Fedora Engineering Steering Committee (FESCo) that is entirely community-elected and makes technical decisions on features, schedules, and is in charge of special-interest technical groups such as our packaging group. Having a central place for technical decision-making means that there's a regular venue where arguments can be heard from both sides whenever someone is suggesting a change, whether that person is a volunteer or a Red Hat employee. We're all members of the same community.

Just about every engineer in Red Hat works for some time in Fedora, since Fedora is the upstream for the Red Hat Enterprise Linux product. Part of my job, and the job of the Fedora Engineering Manager, Tom 'Spot' Callaway, is to make sure that work is coordinated between the internal Red Hat groups that work in Fedora and the external community. When decisions are made by the community, we make sure that the internal groups participate and are informed, and when there is something that the internal groups want to pursue, we make sure they are discussing those needs with the community. In general, it ends up being a pretty smooth interaction.

**Q What is Fedora's vision? By whom or how is it set or defined?**

The Project Leader sets the vision for Fedora, which goes hand-in-hand with our mission to advance free software worldwide. The FPL's vision is often about finding the next big challenge for our project to overcome, as a community. In the past, those challenges have included establishing governance, unifying the way we manage our software, and creating a leadership team for Fedora inside Red Hat. I've spent the last ten months turning my sights outward on two problems—making it easier for people to join our community, and enlarging that community to include all those who remix or reuse Fedora in various ways. Really, the vision can only be a reality if the community agrees it's worthwhile, and it's my job not just to identify that vision, but to enlist the community's help to realise it.

**Q There are some distributions that don't really care about upstream, where the distro developers and maintainers want to push their patches first into the distros to make it stand out from the rest of the crowd. Fedora, I believe, has a strict policy of working with the upstream, and whatever feature sets are available in the final distro are completely in sync with the upstream. What's your take on this and why do you think upstream contribution is more important?**

Upstream contribution benefits the entire FOSS community. It's how the open source development model works—it's about collaboration and constant code review and refinement. When a distribution changes behaviour in a way that goes against the upstream model, three things happen.

First, there's immediately an uneven user experience. Users who try out newer versions of the same software from the upstream find that the behaviour changes suddenly and without warning. They think this is either a regression or a mistake on their part, when in either case the difference has been caused by the distribution vendor.

Second, the workload on the maintainers of that distribution begins to multiply and, in some cases, increase exponentially. The further out of step with the upstream the distribution becomes, the more difficult it becomes to integrate the distribution-specific changes with new upstream releases as time goes on.

Third, because the upstream is testing the interaction of their software with other pure upstream releases, arbitrary changes downstream create problems in those interactions with other packages used in the downstream distribution. Every change begets more changes, and the result is a rapidly accelerating cycle of bugs and resulting patches, none of which are likely to be accepted upstream. So once you get on that treadmill, it's very difficult to get off without harming the users and the community.

### **Q What's the role of the Fedora Project Board, and you, as its chairman?**

We have a Board with five community-elected members and four members appointed by Red Hat, who make policy decisions for the project as a whole. We document our mission and meetings through our wiki

page at [fedoraproject.org/wiki/Board](http://fedoraproject.org/wiki/Board)

One of my jobs is to chair the Fedora Board, and ensure that the governance of Fedora is working as smoothly as possible. I also am the person responsible for choosing the people who will fill the seats reserved for appointment by Red Hat. We turn over roughly half the seats on the Board after each Fedora release, so that there is always a chance for the community to make informed decisions about the leadership of the Project.

I always try to respect the need for balancing different constituencies on the Board, so these appointments are not limited to Red Hat employees. Last election cycle, for instance, I appointed Chris Tyler, a professor at Seneca College in Toronto and a long time Fedora community member, to the Board, which has proved to be an excellent choice. This flexibility goes hand in hand with the

# “We ensure Red Hat is a good open source citizen”

An interview with Max Spevack, the man responsible for managing the Community Architecture team, which makes sure Red Hat plays fair with the FOSS community.

**Q Max, the last time you spoke to LFY was after the release of Fedora 7, when you were the Fedora Project Leader and that release in itself was an ambitious task, considering the merger of Core and Extra. Now, a year and a half later, a period in which we saw three more Fedora releases, what all do you think has changed? What were the important things you had in mind back then, and how many of those set goals have been achieved?**

For me, Fedora 8 was about two main things. The first was maintaining Fedora's innovative trends, while giving the new infrastructure a chance to settle down and get polished. This also included nurturing along the idea of Fedora Spins, which the infrastructure changes and the Core/Extras merge enabled.

The second major thing that I was doing during the Fedora 8 timeframe was working internally with Red Hat to lay out a plan for the future organisation of Fedora. I was ready to step aside as Fedora Project Leader, and when we sat down and inventoried all of the responsibilities that I had acquired over the past two years, we agreed that it would be useful to do three things. First, hire a successor for the Fedora Project Leader (FPL) role (this turned out to be Paul Frields). Second, create an official Fedora Engineering Manager role (this turned out to be Tom Callaway), and third, set up an official Community team within Red Hat, which is the role that I took on.

During Fedora 9, my primary contribution was in

helping to ensure a smooth transition as Paul Frields came into the Fedora Project Leader role and joined Red Hat. We officially changed jobs about halfway through the release cycle, and I wanted to make sure that I gave him the same kind of help that Greg DeKoenigsberg gave to me when I started as Fedora Project Leader.

Simultaneously, of course, Greg and I were putting together the Community Architecture team, and figuring out the ways that it did, and did not, intersect with Fedora. I'll talk more about that later.



Max Spevack

**Q So, now that you're in charge of the Community Architecture team, how does this role differ from that of being an FPL?**

The primary difference between the Community Architecture team and the Fedora Project is the recognition that while Fedora may be Red Hat's *most successful* community endeavour, it is by no means the *only* place where Red Hat interacts with the open source community.

The Community Architecture team is responsible for Red Hat's global community development strategy, leveraging the talent and abilities of the free software

community's ability to elect who they wish to the Board, so we tend to always have a mix of Red Hat employees and volunteers, which changes in a fairly smooth and continuous way every six months.

**Q Tell us something about the Fedora Docs Project. What are the objectives and the to-dos?**

The Docs Project is responsible for creating user-oriented guides and tutorials for Fedora, and also to keep our wiki-based information fresh and well-groomed. Although I don't get to participate in the Docs Project as often or as deeply as I used to, I still spend significant time keeping up with its tasks.

Right now, the most important task on which the Docs Project is engaged is fixing up our own process documentation, so we can enable all the new contributors

to participate fully in writing, editing and publishing. We have an enormous virtual hack-fest happening over the Christmas and New Year holidays, where we will be training new volunteers on how to use tools, edit the wiki, and publish to the Web. In addition, we hope to also make some choices for an upcoming content management system that will make all these tasks easier in the future.

**Q What do you think are the best features of Fedora 10? And your personal favourites?**

I'm very excited about two capabilities in particular. One is PackageKit, and the other is our enhancements to virtualisation. Richard Hughes has built up some incredible capabilities for desktop interaction that, for Fedora 10, allow automatic search and installation of media codecs, which is very helpful for desktop users. In

community worldwide as a force multiplier for the goals of Red Hat.

In short, our job is to ensure that Red Hat is a good citizen in open source communities, and that the same community lessons that have made Fedora successful are applied to other strategic Red Hat projects -- in the education realm, in the OLPC work that Red Hat is part of, etc.

The Community Architecture team still is very active in Fedora—especially in organising FUDCons, worldwide events, and in being the place inside Red Hat that is responsible for Fedora's non-engineering budget.

Therefore, the team really has two focuses. One is an internal focus, making sure that Red Hat as a whole is getting all the benefits possible out of the open source business model that it has chosen—which means building successful communities. The other focus is still in the Fedora space, where we participate more or less the same way we always have, as some of the 'senior leaders' in the Fedora community.

**Q Tell us something about the Fedora infrastructure. What are the different facilities provided by the project to the contributors and what is expected in return?**

The Fedora Infrastructure team, led by Mike McGrath, doesn't get nearly the credit it deserves. It is arguably the most critical piece of the entire Fedora community, because it provides everyone in the project with the raw materials necessary to do their jobs. It's massively volunteer-driven, and I believe that it is more innovative, and provides better services than most fully-staffed and enormously-budgeted IT departments in many companies.

There are a lot of things I could talk about here, but in the interest of keeping the answer short I'll mention the work that we call 'Fedora Hosted' and 'Fedora People', because it is an example of a proactive infrastructure team understanding the needs of a development community and giving them the tools necessary to get their work done.

Fedora Hosted provides repositories, Trac instances, and wikis for various upstream projects that are associated with Fedora. The project is a little bit over a year old now, and it has grown tremendously, to the point where even many Red Hat employees are using it because it is better than some of Red Hat's internal tools that try to serve the same needs.

Similarly, Fedora People provides every contributor with some Web space that can be used for personal git repositories, mockups, etc. This space is activated along with a person's Fedora Account.

**Q Among Fedora Project contributors are RH employees and volunteers. How do you ensure that the project as a whole is not directed by the interests of RH (as it's the primary sponsor) rather than those of the community?**

The answer to this is actually quite simple. There is one set of rules, and everyone plays by it. If you want a feature in Fedora, the process is clear. It doesn't matter if you work for Red Hat, or if you are a student hacking in your spare time. If you follow the processes—managed by John Poelstra, our rock star Fedora Project Manager—then you get your work into Fedora. If you don't follow the processes, then you wait until the next release.

**Q How does the Fedora Project facilitate Red Hat? Also, what do the two entities expect from each other?**

The Fedora Project is upstream for Red Hat Enterprise Linux. Red Hat expects that the Fedora Project will provide innovation, and constantly represent the best of what exists in the open source universe today.

In return, the Fedora Project expects that Red Hat Enterprise Linux will take the best of what exists today, and turn it into a supportable product that represents the best of what will exist for the next seven years. The revenue made by Red Hat's enterprise products allows for (among other things) continued growth and investment in Fedora.

It's a very symbiotic relationship.



the future, though, these capabilities will be extended to add on-the-fly installation for user applications, fonts, hardware enablers, and a lot of other features. That's something that proprietary desktops can't provide because their model revolves around selling software to users, whereas we're in the business of giving it away.

On the virtualisation front, we've made a lot of advances in areas like remote installation and storage provisioning. We're showcasing a lot more flexibility for administrators who want to go from bare metal to a complete virtualisation platform without having to spend time in a noisy closet with their equipment. I'd like to see a lot more people looking at the power and capability of KVM, which is the Linux kernel's built-in hypervisor. With 64-bit hardware becoming the norm, everyone's system is potentially a virtualisation powerhouse and we're going to be in a great position to tap that.

Of course, the advances we've made in PackageKit and in the virtualisation system pieces like *libvirt* and *virt-manager* are all run as independent upstream projects, so all distributions and users can benefit. I imagine that you'll be seeing these advances in other distributions soon enough, but the Fedora platform tends to make that possible through our commitment to leading-edge development through the upstream.

**Q What's your opinion about Linux on the enterprise desktop? In which sectors do you find people are most likely to resist switching over from Windows and Macs? And what do you think the reasons are, behind their resistance?**

As I mentioned before, I think the general-purpose case for proprietary operating systems on the desktop is becoming harder and harder to win. Information interchange becomes trickier, and vendor lock-in is too expensive a proposition for businesses that have to find a steady profit margin in a highly competitive, globalised market. Ultimately, I think there's a broad range of businesses that are served by integrating open source technologies at every level from the edge to the desktop, and one of our purposes in Fedora is to provide a wide proving ground for those technologies, whether they're targeted at the desktop user or the systems architect/administrator, and make them available to as large an audience as possible, for contribution.

**Q There are some essential professional-quality software that are still missing from the 'FOSS desktop', viz. layout software like QuarkXpress and Adobe InDesign, that media houses like ours depend on; or there are professional sound and video editing tools that studios depend on. How can projects like Fedora, or FOSS heavyweights like Red Hat, encourage and facilitate developers of FOSS alternatives to develop something as good as the Linux (kernel), on which professionals can bet on?**

By providing a robust platform for development, integration, and deployment that includes the latest

advances in tools and toolkits, and making it flexible enough for ISVs and appliance builders to develop cost-effective and innovative solutions for their customers. That's something at which the free software stack excels, and which we in Fedora and at Red Hat are constantly advancing through our upstream development model.

We can also advance by illustrating the open source development model as the best way to provide features faster to users and customers. Many software vendors that 'get it' are already moving to the way of doing business that Red Hat has been proving for years. They have a stream of constantly developing technology on the one hand, which feeds a stable, supportable branch on the other, backed by services, support, and training with extremely high value, for which users and customers are willing to pay -- and that puts them in charge of their own technology roadmap.

**Q What's the road map of Fedora, and what can we expect in Fedora 11?**

As we set the schedule for Fedora 11, we acknowledged that we were getting towards the time when Red Hat will be looking to branch our feature set for use in its next edition of the enterprise product, Red Hat Enterprise Linux 6. So there're quite a few features we want to get entered into our Fedora 11 release, and we track those openly and transparently, like everything in our project. Have a look at [fedoraproject.org/wiki/Releases/11/FeatureList](http://fedoraproject.org/wiki/Releases/11/FeatureList)

That list changes over time as the FESCo evaluates developers' proposals, and makes decisions on how best to include that work in the Fedora platform. In addition, there are always quite a few features and initiatives that come out of our engineering-focused North American FUDCon conference, which is happening January 9-11, 2009, in Boston. I would expect in the weeks following that conference, that the list will be expanding quite a bit, but some interesting additions are the Windows cross-compilation toolset and the introduction of DeviceKit.

**Q Thanks for your time, Paul. Is there anything else you'd like to share with our readers?**

I have never been so excited to be part of free and open source software. I would encourage readers to not only use the software we develop, but to consider how they can get involved in Fedora to advance the FOSS ecosystem as a whole. Even doing simple things like filing bugs, fixing text on a wiki, or writing small tutorials, can be useful to hundreds or thousands of people. Getting involved in free software was one of the best and most fulfilling decisions I've ever made, and I hope you'll consider making the jump from consumer to contributor as I did.

Thanks for the chance to talk to your readers!  **END**

By: Atanu Datta

He likes to head bang and play air guitar in his spare time. Oh, and he's also a part of the LFY Bureau.



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# Fedora India

## A Collaborative *configure & make*

A sneak-peak into the Fedora Project and the India-based community around it!

For a large number of users, developers and contributors, 'Fedora' is a Linux-based operating system that provides them with access to the latest free and open source software in a stable, secure and easy-to-manage form. Fedora is both an epicentre of innovation in free and open source software (FOSS), and a community where developers and enthusiasts come together to advance FOSS.

The Fedora community includes software developers, artists, systems administrators, Web designers, translators, writers and speakers, making it the most vibrant community to be a part of.

### The Indian community

There has always been a strong user base of Fedora right from the early days of Fedora Core 1. Over a period of five years in which Fedora saw a release of 10 versions, the community in India has also evolved. From being mere consumers/users of the operating system, there has been an organic transformation into a community of active participants and contributors. An increase in the number

and forms of contribution has also helped to ideate about the focus and objectives of the community in India.

As a result of the increasing number of members, there is an active set of discussion forums on the mailing list and the IRC channel. This has enabled an exponential growth in Fedora's reach, adding to the word-of-mouth growth of its users and contributors in India.

### Plans

The initial momentum to participate in the Fedora Project arose from the need to localise the operating system and relevant content into Indian languages. Thus, there has always been an active Indic localisation community around Fedora, and their stellar contributions can be seen in the recent release of Fedora 10.

Thus, although Indic localisation was the primary driver, the larger goal has always been to increase the quantum and quality of contributions to the Fedora project. A set of smaller objectives has been put in place to achieve the goal. To get a quick overview, let's put the tasks into the following three categories:



- **Infrastructure:** For a significant number of potential contributors, the unavailability of bandwidth limits access to the Fedora binaries and source. To ensure media availability, the FreeMedia program (coordinated in India by Siddharth Upmanyu) works with the Fedora Ambassadors (coordinated in India by Susmit Shannigrahi) to put in place a system combining Ambassadors and local contacts, who would be geographically dispersed to be able to accept requests from users and contributors and provide the media.

Linux and IT magazines that carry Fedora media with their issues also contribute to this process because of the subscription numbers that allow a larger number of Fedora media to be available for use.

- **People:** The most important aspect about the Fedora community has been the people who participate in it. The community in India has been organising classroom sessions on IRC, and sometimes talks to mentor the new contributors. Nurturing a community begins by guiding people to contribute, and there are ways for everyone to become a contributor to the Fedora project. Especially in India, contributors have been actively talking with students who are interested in working within the Fedora project as part of their summer projects and internships. Students who want to contribute to Fedora and get to see their code being used by a large segment of the user community should start ideating on *#fedora-india* (on *irc.freenode.net*) or on the Fedora-India mailing list (on *listman.redhat.com*).

The Fedora Ambassadors, developers, and language maintainers have taken the lead in building up the community and handholding contributors through the initial days. They also collaborate with LUGs and similar user groups to conduct workshops and orientation sessions by which users can be guided to use a desktop like Fedora.

- **Presence:** To reach out to the new users and contributors, the Fedora Project needs to be present at events. And, the best way to reach out to students is to get Fedora Ambassadors and developers talking at various college and university tech events -- about the cool ways to become a participant in the Fedora Community. Besides the well-known events that dot the Indian FOSS conference landscape, making Fedora's presence felt at smaller conferences and workshops makes it easier to express the ways in which one can participate in the Fedora project.

## Projects

There are lots of opportunities within the Fedora project that allow an interested contributor to pick up the required skills and begin contributing. Some of them relate to bug fixes within the OS, some include creating tools for ideas that have been put on a wish list. These could be of special interest to students, who get to learn about the fundamental building blocks of computer

science theory as part of their curriculum.

Participating in a FOSS project like Fedora teaches them skills that would come in handy once they start their careers in the software industry. Writing code, understanding peer reviews, participating in virtual development teams, building up communication skills, and understanding the nuances of licensing are competencies that would stand them in good stead. More importantly, the collaborate-to-innovate nature of FOSS contributions would make them into better developers and contributors. And, since their contributions are out in the open on publicly-available source control systems, they end up having a portfolio of work that can be put on their CVs.

A significant number of Fedora contributors from India are available on the IRC channel *#fedora-india*. And these are the folks who can guide the students to appropriate tasks. It does require some level of initial handholding while learning skills that go into producing FOSS. But once the initial skills are picked up, it is just a matter of interest and competence. There are projects on FedoraHosted that require contributors across a variety of disciplines—code, documentation, localisation, artwork, bug triaging, bug fixing, etc.

In recent times, members of the community have also put up interesting projects like Indian On-Screen Keyboard (iok), Review-o-Matic, and Translation-Filter, which provide an opportunity for new contributors to join right in. All these projects are available via FedoraHosted.

## Looking forward

In the coming years, the plan for the Fedora community in India is to work towards making it diverse and more passionate. A small set of indicators allows anyone to gauge the health and direction of a 'community'. These range from regular meetings, both in person and over virtual media like IRC, to estimating the quantum of innovation that is being contributed. A community requires a sense of 'everyday trust' to be nurtured. More so because it is a collection of a large number of personalities who share a common passion.

To keep the creative spark alive, the best thing to do is to set well-publicised goals and achieve them. Having a public roadmap and a tracking mechanism keeps everyone motivated with a sense of achievement. Additionally, it should also be easy to join a community and become an active participant in the process. Removing the barriers to initial contributions while addressing various concerns is also an important aspect.

The *#fedora-india* IRC channel on *irc.freenode.net* and the *fedora-india* mailing list on *listman.redhat.com* are the primary means of getting in touch with and becoming part of the Fedora community in India.  **END**

**By: Sankarshan Mukhopadhyay**

The author has been using Fedora since the days of Fedora Core 1. He can be reached at *morpheus at fedoraproject dot org* or, as *sankarshan at jabber dot com* on IM.

# Like the Comfort Of Your Locality

Amongst the over 80 languages currently under maintenance, nearly 15 Indian languages are already part of the Fedora Localisation Project. And there sure is room for a lot more, so join in!

Localisation is when internationalised applications adapt their functioning to include the display, input and output, according to the rules of a native language and culture. This is a particularisation process, by which generic methods already implemented in an internationalised program are used in specific ways. The programming environment puts several functions to the programmer's disposal, which allow this runtime configuration. The formal description of specific sets of cultural habits for some country, together with all associated translations targeted for the native language, is called the locale for this language or country. Users achieve localisation of programs by setting proper values to special environment variables prior to executing those programs, and by identifying which locale should be used.

In most cases, localisation projects are sub-projects of a mainstream project—be it a distribution, desktop or any other application. These sub-projects are administered by dedicated coordinators from the main project and executed by individual language teams. Localisation tasks and schedules are worked into the main project's schedule to ensure a seamless release.

## FLP worldwide

One of the biggest localisation projects worldwide is the Fedora Localisation Project

(FLP). Amongst the over 80 languages currently under maintenance, nearly 15 Indian languages are part of the FLP already. Translations for a few of these languages, like Bengali, Hindi, Tamil and Punjabi, started as early as Fedora Core 1 and are still being actively maintained. The bits available for localisation in Fedora include the user interface of applications, Fedora documentation (including guides and release notes), various Fedora websites, etc. The teams choose the components for translation as per their contributor base and requirement. Although localisation work gains speed close to major release times, it can be carried on post-release too for some components.

## Groups and administration

The Fedora Localisation Project is organised as a collective of language teams for each language, led by a coordinator who serves as the main point of contact. The overall project is led by an elected group of seven members who form the Fedora Localisation Steering Committee (a.k.a FLSCO), currently chaired by Dimitris Glezos from Greece. Its mission is to provide the Fedora translators with the necessary guidance, and support their efforts to localise the Fedora Project to multiple languages and cultures. The committee coordinates the translation schedule with the Fedora Release Engineering group, and provides translators

with the necessary infrastructure to contribute translations. Open IRC meetings are regularly held for the Fedora Localisation Project participants. A round up of the FLP's weekly activities is also reported in the Fedora Weekly News.

## Tools

The starting point for the FLP is [translate.fedoraproject.org](http://translate.fedoraproject.org). This contains the list of all the languages and dedicated pages to reflect per-release translation completion statistics. Additionally, this page can also be used to access the *.po* files that are used for translations. Translations can be done offline using a translations editor.

Eradicating the need for cumbersome version-control operations, translated *.po* files can be directly submitted via the Transifex instance hosted on [translate.fedoraproject.org](http://translate.fedoraproject.org), into the main back-end repositories of each package. This is especially useful for the localisation group, as Fedora allows the use of multiple version control systems according to the convenience of the package developers. Submission access to the repositories via [translate.fedoraproject.org](http://translate.fedoraproject.org) (and Transifex) is authenticated using the centralised Fedora Account System (FAS).

Currently, some projects related to Fedora (like: PackageKit and PulseAudio) have chosen to be hosted on [translate.fedoraproject.org](http://translate.fedoraproject.org) to receive translations. This set-up is maintained by volunteers from the FLP and the Fedora Infrastructure Team.

## Participation


Localisation projects provide a considerably flexible platform for contributing to a free software project. Armed with the skill to read/write one's language and a fair understanding of the project/product of their choice, people can start contributing and work their way around a sizeable community group. Besides l10n, the Fedora Localisation Project provides opportunities to volunteers for various other activities like back-end

infrastructure maintenance work, Web interface designing, content enrichment and documentation, and communication. A sizeable number of volunteers from the Fedora Localisation Project are also Fedora Ambassadors in their region.

## India

Similar to the global structure of the Fedora Localisation Project, the Indian languages also have a group of dedicated localisers who contribute translations for each release. A minor hiccup is the varied numbers in each individual language's contributor base. However, with the collaboration-driven model of the Fedora Localisation Project, the entry barriers are negligible. With the increase in activities of the Fedora India Ambassadors group, the localisation project is also slated for an inevitable boost in India. The localisation teams work within the Fedora community in India to promote and enhance localisation work.

## Joining up

Besides fulfilling the common pre-requisites for participation (for example, FAS account and self-introduction) as mentioned in the FLP wiki page, potential contributors are expected to contact the coordinator/team for their language. The individual language groups coordinate their activities as per their internal goals and standardisation/operational procedures. The primary communication details are listed on [translate.fedoraproject.org](http://translate.fedoraproject.org) for each team. Additionally, help is always at hand on [#fedora-l10n](https://fedoraproject.org/wiki/IRC) and [#fedora-india](https://fedoraproject.org/wiki/IRC) IRC channels (on Freenode server) and the [fedora-trans-list@redhat.com](mailto:fedora-trans-list@redhat.com) and [fedora-india@redhat.com](mailto:fedora-india@redhat.com) mailing lists.  **END**

**By: Runa Bhattacharjee**

The author has been contributing to FOSS projects like Fedora, GNOME, KDE, etc, for over five years. She can be contacted at her e-mail address: [runab@fedoraproject.org](mailto:runab@fedoraproject.org) or on IRC as [#mishti/runa\\_b](https://fedoraproject.org/wiki/IRC).

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# Now, Package Management is Intelligent by Design

Check out PackageKit, a distribution-neutral software manager.



In the good old days, the way you learnt about Linux was to build your own distribution and of course, design your own package manager as well. After all, what was the point of having your own distribution if you didn't even write a custom package manager, right? As a result of that, package managers, packaging formats and dependency resolvers are a dime a dozen these days, in Linux. While most of them are as obscure as some of the distributions themselves, there are enough popular variations.

While we hail this as freedom and choice, this does have a cost associated with it. Users have to keep relearning the differences between software management tools. Not just distribution hoppers but also systems administrators who have to deal with different distributions all the time. Many applications developers would love to install additional software or content on demand instead of worrying about

differences between distributions. Fortunately, *yum install foo* is not conceptually different from *apt-get install foo*. It is possible to abstract away the differences and provide a distribution-neutral interface for both users as well as developers.

## Lo and behold! Enter PackageKit

Richard Hughes, a Red Hat developer, the maintainer of GNOME Power Manager and a contributor to other software such as HAL and DeviceKit, took a look at the landscape of graphical software managers in Linux a couple of years back and found that while each of them had their own advantages, they were essentially reinventing the wheel with their own quirks. And since distributions have a long history of investment in their own packaging tools, they weren't going to give up easily.

He decided to develop PackageKit from scratch in a distribution-independent way.

Now, after a couple of years of work, PackageKit is well on its way to becoming the standard software manager in the near future and is already the default in Fedora 9 onwards, while other distributions such as SUSE and Ubuntu are adopting it as well.

PackageKit is a tool designed to make installing, removing and updating software easy, and to provide the same graphical interface across multiple distributions. How is this possible? Before we get to that, it is important to understand what PackageKit is *not*. It is not a replacement for the dependency resolvers such as *yum*, *apt* or *zypper*. It does not do any dependency resolution on its own. PackageKit provides neutral interfaces for common functionality, such as installing or removing a package, which is mapped into the distribution-specific backends that take advantage of the native tools already in the distribution to do all the grunt work. The goal: in the near future, all distributions will share the same interfaces and for the most part you don't have to worry about the underlying tools.

Before we move on, let's take a quick look at the graphical interface shown in Figure 1. This one is the GNOME frontend.

PackageKit is a UI-agnostic library. There is KpackageKit under rapid development, which you can easily guess is a KDE frontend to PackageKit. They share the same common library.

As you can see in Figure 1, there is a fairly standard hierarchical view of packages in a Fedora 10 software repository. You can install software as a collection that is quite useful if you want all the packages that form the new LXDE Desktop Environment in one go, for instance. The filtering capabilities are a bit unique. Let me explain that a bit more. You can filter the applications that are shown based on whether they are graphical or non-graphical, for development or regular use, have been installed or not installed, and also whether they are free and open source, or proprietary.

The last part is interesting. As I noted before, the functionality is dependent on the underlying package manager. RPM stores the licensing information within the metadata itself and it is possible to sort and filter, based on this. Other formats like the one used by Debian do not. PackageKit enables or disables parts of the graphical tools automatically, based on whether the underlying backend supports it. So it is entirely possible to have a partially-supported backend in PackageKit and add more support incrementally. If you are a developer of a small distribution with its own unique package manager, writing a backend to hook it up with PackageKit is much more effective than writing all the tools on your own, and this is exactly what many smaller distributions such as Paldus do, saving them lots of redundant work.

## Major unique features

PackageKit is quite sophisticated and takes advantage of a number of new technologies. It integrates with PolicyKit, which allows a very fine-grained security model. I can, for example, give access to update my system to my family



Figure 1: The PackageKit GUI



Figure 2: Do you want to run the newly-installed application(s)?

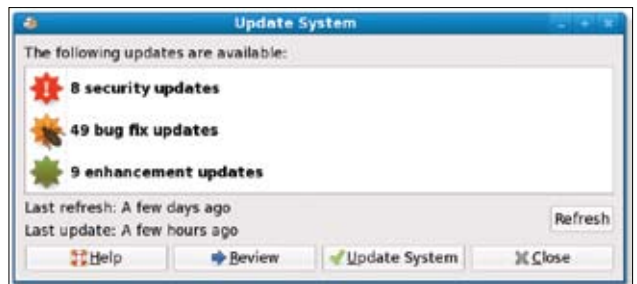


Figure 3: Updates classified as security, bug fix and enhancement updates

members but not let them remove any packages from it. PackageKit also has a daemon that is activated on demand and does not waste system resources. It is also session-aware and doesn't break just because you end your session or have fast user switching to let another user log in.

Despite all this, PackageKit is fundamentally tuned to the basic needs of users and all the features are developed with this in mind. Recently, PackageKit added a number of new interesting features as well. Let's briefly go through the major features that make PackageKit unique, very user friendly and way ahead of other desktop software management tools.

## Easy run

When you install an application or a group of applications, PackageKit prompts you to run them. This is quite useful because non-technical users often are not able to find where the newly-installed application can be located. Linux desktop environments usually have a well-categorised menu, but PackageKit makes it even easier and more user-friendly. Refer to Figure 2.



Figure 4: Update settings



Figure 5: Notification on the availability of a new OS version



Figure 6: Upgrade to new distro version with PreUpgrade



Figure 7: PackageKit informs you of the need for additional codec installation

## Classification of updates

PackageKit classifies updates under security, bug fixes and enhancements, and you can choose to selectively update

either interactively or set the preferences to automatically install them. If you are on a low-bandwidth connection, setting it to auto install security updates might be an ideal thing to do.

## Environment aware—bandwidth and power management

PackageKit is aware of when you are using a mobile Net connection, and does not drain your bandwidth and increase your bills even if you have set it to update automatically (Figure 4).

It is also aware when you are running on battery, and it wouldn't run updates by default in this case. The option to tweak this is an advanced setting not visible via the preferences dialogue box but you can change it via a GConf key.

## Distribution upgrades

With the fast pace of free and open source software updates and many community distributions like Fedora coming up with new releases virtually every six months, users are often unaware that a new release is available. They continue to use old and outdated releases, sometimes even without getting any security updates, which leads to potential security issues.

PackageKit makes the process of upgrading to a new release just a bit easier. When a new release is available, PackageKit provides a notification on your desktop itself (Figure 5).

The upgrade process is managed by the native distribution tools. In Fedora, that's PreUpgrade, which provides an online way to upgrade to a new release easily.

When a user initiates an upgrade, PackageKit downloads PreUpgrade and executes it. PreUpgrade then continues doing the actual upgrade process (Figure 6).

## On-demand installation

In Fedora 10, PackageKit has a feature of adding codecs on demand. Let's suppose you click on a music file, which is encoded in a format that doesn't have support for it out-of-the-box. In most cases, previously you would get a cryptic error and you wouldn't be able to do much with it. With PackageKit, there is a *gststreamer* plug-in and you get a nice descriptive dialogue box that guides you through the process (Figure 7).

Of course, you still need an appropriate plug-in, which is available in the repository. In the case of Fedora, you would need a third party repository like RPM Fusion enabled, but PackageKit will figure out the right plug-in all by itself. On demand installation is supported just for codecs now but much more is planned for future versions. More on this later.

## Service packs—offline software installation

In Linux distributions, a rich choice of the software packages and updates is usually available in a central software repository, but not everybody has a broadband



connection to get the software. And in India, this is still a common issue. It is only appropriate then, that an Indian participant in this year's Google Summer Of Code, Shishir Goel, did the work to enable this particular feature in PackageKit. There are many command line utilities that can assist a user in this task, but they are often distribution dependent and cumbersome. PackageKit offers a very easy alternative in the form of service packs. Service packs are merely software packages and its dependencies wrapped in a standard tarball format. The user can select the dependencies to be packed using an additional option. Along with the dependencies, a service pack has a file named *metadata.conf*, which contains the distribution name, version and the date the pack was created.

For the command line junkies, *pkgenpack* is the command client that uses PackageKit to do the work. A simple example would be:

```
# pkgenpack --output=/media/disk/Rahul --package=xpdf
```

This generates a file */media/disk/Rahul/xpdf-fedora-10-i686.servicepack* on my USB key. A friend of mine can take my USB key, go home, insert the USB key and double click on the service pack file to be prompted to install *xdf* along with dependencies included within the service pack itself. That's just one example. You can do much more, including transferring updates. Do refer to the very well-documented man page for more details.

## Future plans

This write up is based on the latest stable version of PackageKit and is already a bit outdated at the time of writing, since PackageKit is under very active development. It has a number of upcoming features planned or already available in the development versions.

The on-demand installation feature, like the one I hinted at earlier, is being expanded to cover more than just codecs.

## Font support

Let's suppose your native tongue is Hindi. If someone sends you a document in Hindi and you don't have a Hindi font installed on your system, you would normally get an odd mix of characters that makes no sense at all. With newer versions of PackageKit, however, when an application opens a document, which requires a particular type of font that is not installed but available in the distribution's software repository, PackageKit will automatically be able to search (Figure 9) and install it. So if you always wanted to read Greek love letters, here is your chance!

## Mime support

PackageKit goes even further. What if you don't have an application installed that can open the document in question? No worries! PackageKit can take care of that as well.

In Figure 9, PackageKit is asking to search for an

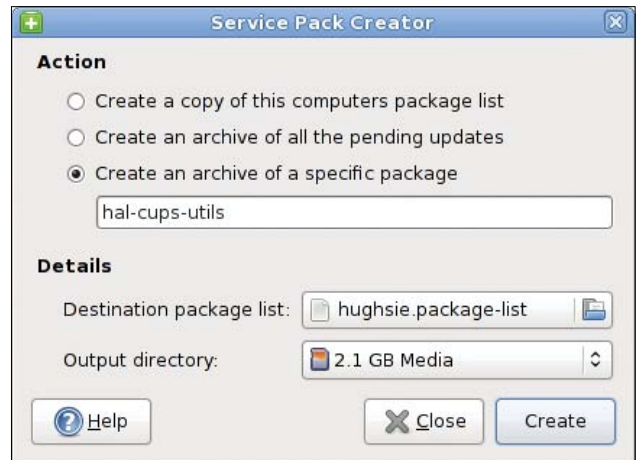


Figure 8: Service Pack Creator to upgrade packages offline later




Figure 9: PackageKit prompts to search for missing fonts



Figure 10: PackageKit prompts to look for an app to access missing mime type

appropriate text editor to open the document, but other documents or mime-types are supported. When multiple applications are able to handle a particular document type, you will be presented a list of choices to pick from with the distribution default shown first.

As you can see, PackageKit aims to enable users to move away from installing software just because they might need it some day, to installing software on-demand instead. There are many other new features in the pipeline as well, but time's running out just now. We'll talk about these another day, maybe. Till then, enjoy PackageKit and join us for questions in order to hack PackageKit at [www.packagekit.org](http://www.packagekit.org). **END** 

**By: Rahul Sundaram**

The author is a Red Hat engineer and active contributor to the Fedora Project, and has contributed a bit to PackageKit as well. He likes to dabble in and write about new and interesting things in the free software space. He can be reached via e-mail at [sundaram@fedoraproject.org](mailto:sundaram@fedoraproject.org) and via IRC at [mether@freenode.net](irc://freenode.net/mether)



# Virtualisation Out-of-the-Box

Fedora 10 neither offers the geeky Xen, nor the easy-to-use VirtualBox, and yet it's a virtualisation powerhouse. Huh? Did I miss something?

2006 was a grand year for virtualisation fans. And why not? SUSE Linux Enterprise introduced the much-hyped Xen in its official offering. Meanwhile, kernel 2.6.20 integrated KVM (Kernel Virtual Machine) in its main tree, which Fedora 7 packed in the following year.

While Xen offers a pretty complicated offering—requiring you to boot a patched Xen kernel to create and run virtual machines—KVM is a loadable module that works with the distribution's default kernel. The only requirement is that your processor should have the hardware assists for virtualisation, which most processors that came out in the last few years, do have.

LFY did carry a tutorial on KVM in its October 2007 virtualisation special issue. It talked about how to get started with this technology using the default command-line

tools. Although that may be the preferred way for most geeks, us plebs would rather have everything as GUI wizards that don't require us to remember too much command-line jargon.

## Fedora 10: It's only KVM!

Going back to as early as Fedora 7, the project introduced one tool called the Virt-Manager, which integrated support for Xen, KVM and Qemu. With the latest Fedora 10, there's however no Xen kernel being offered. Take a look at Figure 1—it's only KVM under the virtualisation section. Seems like the die-hard Xen fans would have to wait another six months for Fedora 11. Like I care!

For my virtualisation needs, I've been using the VirtualBox OSE edition that many distros pack in by default, viz. Mandriva, openSUSE, etc, for a while now. So, after installing Fedora 10, I obviously had plans to install it. But alas!

Fedora doesn't include that in its official repositories.

As furious as I was... in a rage I ended up selecting all the seven packages listed under the 'Virtualization' section in PackageKit (Figure 1) to see what KVM had to offer me. It turned out that KVM is not bad at all. I have even configured a network bridge—needs more steps when it's a VirtualBox—by simply editing a couple of files by hand. But more about that later... Let me first walk you down the path of easily creating virtual machines using this nifty GUI wizard called Virt-Manager using KVM.

## Click Next—step-by-step

Now that you have the required tools installed (you did install the tools, didn't you? See Figure 1), it's time to run another 'guest' OS from within Fedora 10. Launch the Virt-Manager from *Applications menu*→*System Tools*→*Virtual Machine Manager*. It'll prompt you for a root password—yes, you can run it under the under-privileged mode as a normal user too, but that's another story.

This will launch a bare-bones empty window as shown in Figure 2. Click on *File*→*Add Connection...*. This will bring up the window where you need to select the hypervisor that Virt-Manager will use. By default, it will show Xen. Click on the drop-down menu and select *QEMU*, because KVM uses this one to function. Let the *Connection* type remain 'Local', as we'll create the virtual machine on the local system. Now, click the *Connect* button. A *localhost* entry will appear in the Virt-Manager window.

Now we can click on the *New* button at the bottom right corner of the window to create a new virtual system (Figure 3), with information on the steps to follow. However, before we do that it's better we set up the networking system that will aid our guest OS first.

## Networking anyone?

There can be two types of networking—a virtual network (viz. NAT), or a shared physical device (your Ethernet card). The former is okay, if you don't want to access your guest OS from the host system—which is also the default in VirtualBox. This is configured in Virt-Manager by default. To check it, click *Edit*→*Connection Details...*. This brings up the 'Host Details' window. Select the tab that says *Virtual Networks*. There should be an interface called *default* listed on the left-side pane, with the details of the network on the right side as shown in Figure 4.

But just in case this screen is empty, there's no reason to panic. Clicking the + [plus] button at the lower left corner of the window brings up a new wizard for creating the virtual network with details of the steps to follow. Click *Forward* and set the name of the network to whatever you like (viz. *default*). The next window gives an IP range; the default 192.168.100.0/24 is cool. The next screen lists the DHCP beginning and end of the IP range. The default again is okay. The following window is a bit tricky—you have an option between an 'isolated virtual network' or 'forwarding to physical network'. If you want the Internet to work on the



Figure 1: PackageKit: Where's Xen? It's only KVM

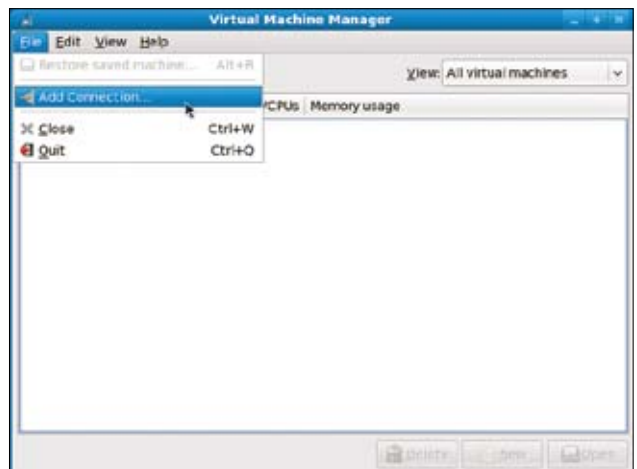


Figure 2: Virt-Manager first run

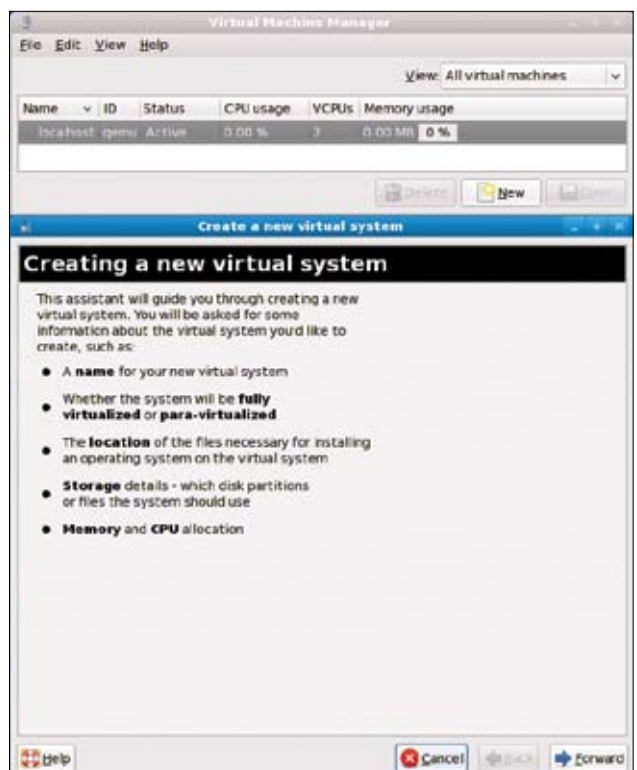


Figure 3: Create a new virtual system



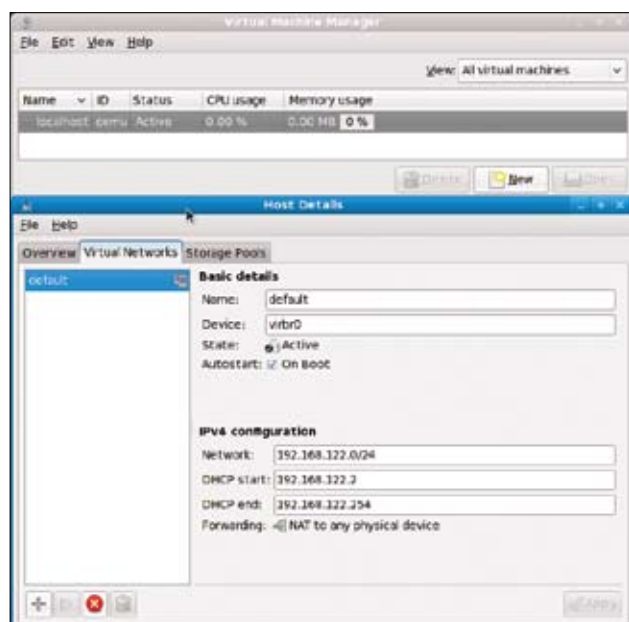


Figure 4: The default virtual networking interface

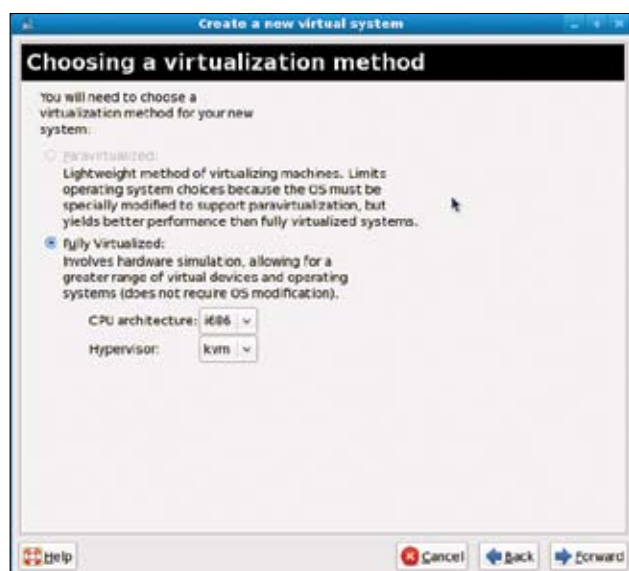


Figure 5: Select a virtualisation method

guest OS, then you need to select the second option and from the drop down window, select the option that says 'NAT to any physical device'. The following window gives you a summary of the virtual network. Simply, click *Finish* here. There... *now* does your screen look like Figure 4?

However, this sort of a NAT-based set-up is invisible from systems on your LAN. In fact, forget LAN, you can't even access the guest system from within the host system by means of tools like *ssh* or *ping*. So what is to be done now? This is where the bridged network comes into the picture. To set it, you first need to edit the `/etc/sysconfig/network-scripts/ifcfg-eth0` file as the root user. By default, it should look somewhat like the following:

```
# nVidia Corporation MCP67 Ethernet
```

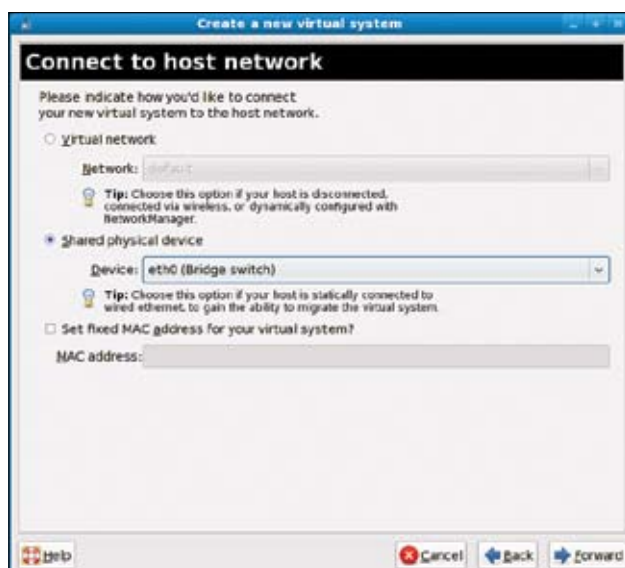


Figure 6: How to connect to the host network?

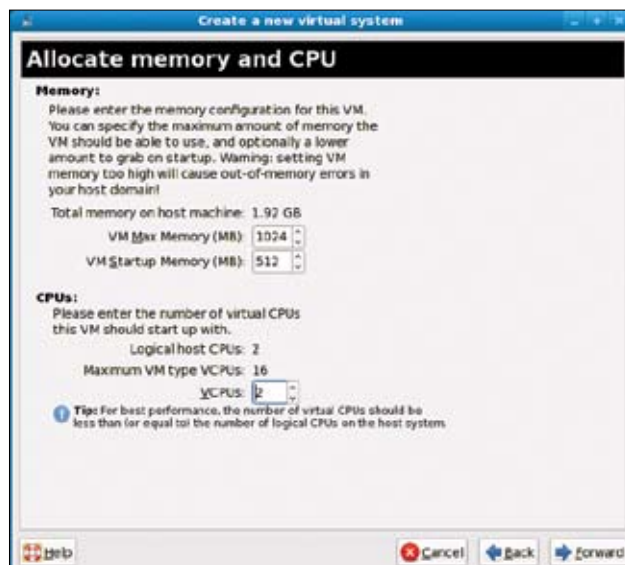


Figure 7: Allocate memory and CPU

```
DEVICE=eth0
HWADDR=00:1d:60:66:aa:3b
ONBOOT=yes
BOOTPROTO=dhcp
USERCTL=yes
IPV6INIT=no
NM_CONTROLLED=no
TYPE=Ethernet
PEERDNS=yes
```

In here, you have to make the following changes:

- comment out the *BOOTPROTO* line
- Add a new line: *BRIDGE=switch*

Here's what mine looks like after the editing work:

```
# nVidia Corporation MCP67 Ethernet
```

```

DEVICE=eth0
HWADDR=00:1d:60:66:aa:3b
ONBOOT=yes
#BOOTPROTO=dhcp
BRIDGE=switch
USERCTL=yes
IPV6INIT=no
NM_CONTROLLED=no
TYPE=Ethernet
PEERDNS=yes

```

Now we need to create another file called `/etc/sysconfig/network-scripts/ifcfg-br0` and add the following text to it:

```

DEVICE=switch
BOOTPROTO=dhcp
ONBOOT=yes
TYPE=Bridge

```

Now restart your network as follows:

```
service network restart
```

The idea is that the bridge *br0* should get the IP address (either DHCP or static) while *eth0* is left without one. Don't ask me *why* now. I Googled for how to create a bridge so that I could use my shared physical Ethernet for networking with the guest, and found the solution at [kvm.qumranet.com/kvmwiki/Networking](http://kvm.qumranet.com/kvmwiki/Networking).

That's it! Now that our initial hitch with the networking set-up is done (which we'll eventually require later), let's move on to creating a virtual machine.

## Back to real business

Take a look at Figure 2 once again. You're back in this window. Click the *New* button, and you're now in Figure 3. Clicking *Forward* here will ask you to enter a name of the system that you'll create. I put 'openSUSE11.1' here as I have an openSUSE 11.1 RC KDE Live CD. After clicking *Forward* again, the next step is where we need to select the virtualisation method. Nothing much to do here as you can see in Figure 5—the paravirtualisation option is grayed out as KVM is a full virtualisation solution, unlike Xen. You will also notice in this window that the CPU architecture and hypervisor are already defined as i686 (unless your host system is an x86-64 OS) and KVM, respectively. So, just click *Forward* again.

This next window is where you'll need to define the installation method. By default, it's 'Local install media (ISO image or CDROM)'. I used this! You can also go for a Network or PXE installation, but then you're on your own :-)

Below that you can define your guest OS type and version/distribution. By default, both are defined as 'Generic' and you may leave them as they are if you aren't too particular. Otherwise, please take a look at the options and see if it has what you're looking for.

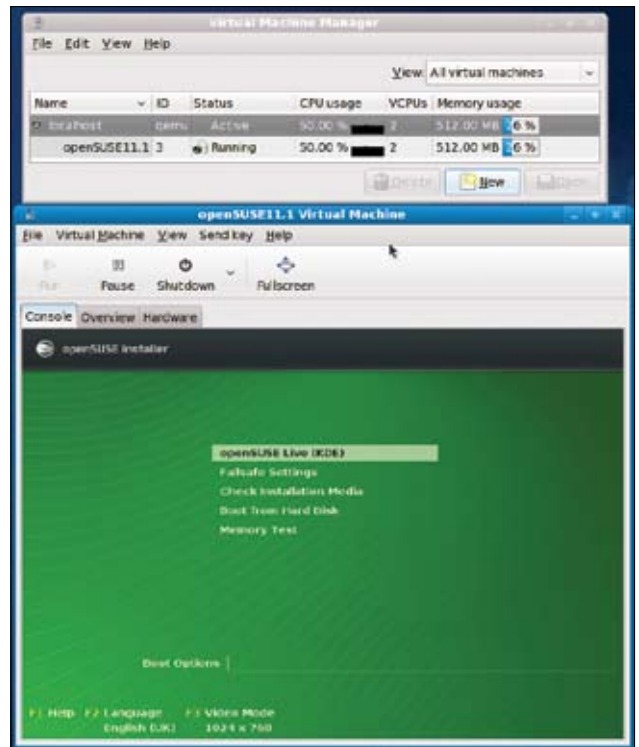


Figure 8: Virt-Manager booting the openSUSE 11.1 RC KDE Live CD

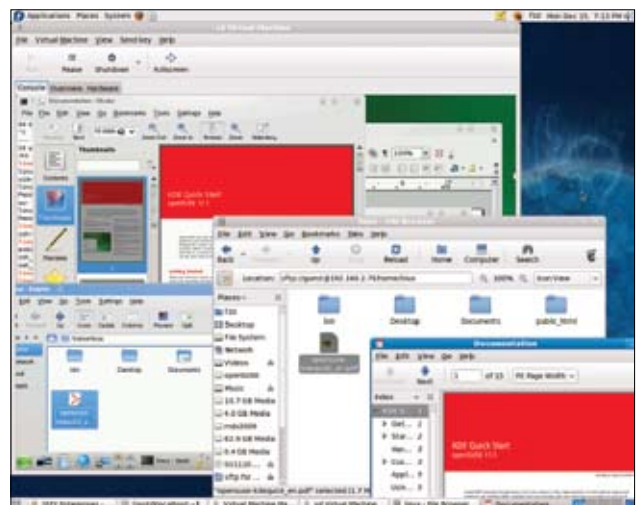


Figure 9: Accessing the guest's home directory from the host's Nautilus file manager

The following window inquires about the location of your installation media—an ISO image or a CD/DVD media. I had the openSUSE image in my hard drive, so I simply pointed to that by hitting the *Browse* button. You can also place a bootable media in your CD/DVD drive instead.

The next screen is where you'll assign storage space—a disk image file (selected by default), or a regular disk partition. I opted for the default disk image route, and was also satisfied with the predefined file size as 4000 MB—a live CD can't have more than 2.5 GB of data after installation, which leaves me more than a GB for swap and/or additional free space. So, I moved *Forward*.

The following window is where you define the

networking details (Figure 6), and this is where the game becomes a bit tricky—which is exactly why we've already set up networking first. You can either have the virtual system to use a virtual network (the *default* interface we discussed earlier), or a shared physical device (your Ethernet card). The latter should appear as "eth0 (Bridge switch)" if you have followed the initial networking set-up steps. I selected this option and moved *Forward*.

This is where we need to allocate the memory and CPU information (Figure 7). I hope you have sufficient memory, as this is the most important aspect of successfully running virtual machines. So, I'd recommend reading the information provided in this screen very carefully. Out of the 2GB memory I have in my system, I allocated 1024 MB as the 'VM Max Memory' and 512 MB as 'VM Startup Memory'. Also, since my CPU is an AMD dual core, I've two logical CPUs; hence, I have defined the number of virtual CPUs for the guest OS as two.

Moving *Forward* will display the summary screen with the different parameters we've set in the configuration steps. Hitting the *Finish* button here boots the install/Live media. This opens a new window where you can see your guest OS boot (Figure 8). You know what to do next, don't you? Use it as you would use any other OS.

This, in fact, is an excellent way to quickly test beta-quality releases like the openSUSE11.1 RC release I am using here. After a successful boot, it picks up an IP supplied by an Airtel broadband router, just like my host OS, and appears to be just another machine in the LAN. In Figure 9, notice that I'm accessing the home directory of the guest OS from my host OS using *ssh* over Nautilus. Note that I'm also accessing the KDE Quick Start Guide from within the guest (where it's actually located), as well as the host.

Similarly, accessing websites from the guest OS is also as simple as launching Firefox and keying in the URL. The guest OS will send the request directly to my router and retrieve the data.

Now, installing this Live CD as a guest OS is also just like you'd install your regular (host) OS. The only difference is, perhaps, the partitioning. Since I exported a file image during the configuration steps for storage space, it'll appear as a blank (raw) hard disk to the guest OS. I accepted the default partition set-up suggested by openSUSE—approximately 500 MB of swap and the rest as root. To tell you the truth, I accepted all the defaults during the installation process to quickly get done with it. Figure 10 shows the guest OS after installation. Installation is not really necessary but... hey, it's possible, so why not?

Of course, there are a few other tweaks possible even after installation. Like what if you would like to increase the maximum memory (RAM) allocation for the guest OS on-the-fly? Click on the *Hardware* tab on the Virtual Machine window. Select the *Memory* parameter from the left pane, and there you have it (Figure 11).

Other hardware changes are also possible, like start-up memory for the VM, the number of virtual CPUs, etc, and can be done offline—that is, after switching off the guest

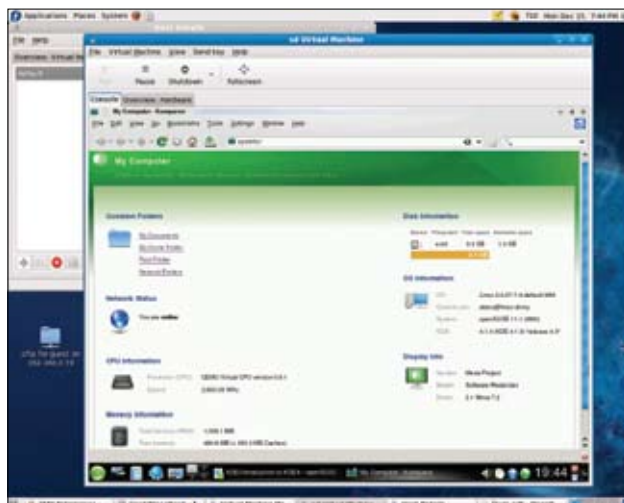


Figure 10: Guest OS after installation

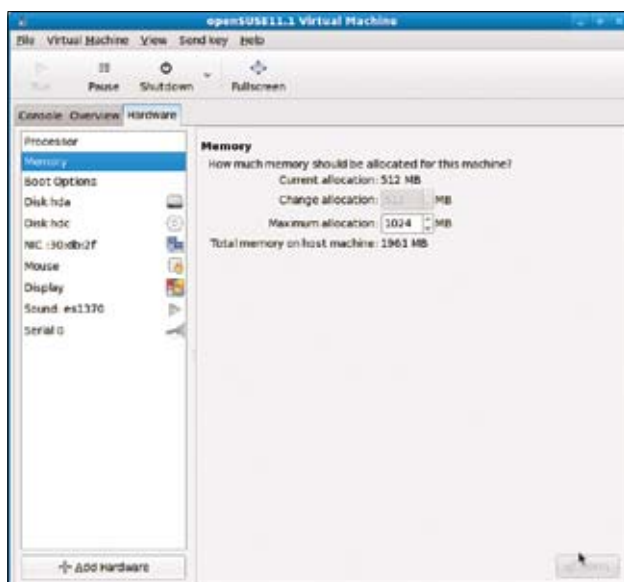



Figure 11: Change max memory available to the guest OS on-the-fly

OS. Go through all the hardware parameters available in the *Hardware* tab to get yourself familiar with it. Clicking the *Overview* tab, on the other hand, gives you information about the CPU and physical RAM that the guest OS is currently using. Pretty simple, isn't it?

## Closing up

Finally, my business is done here! Obviously, there's a lot, lot more that KVM (and even the GUI wrapper called Virt-Manager) is capable of; I've only managed to touch base with the easily-accessible upper crust. This Virt-Manager plus KVM is a new thing for me, so I wanted to share my explorations with all of you. Catch you later when I have something else to rant about. **END** 

**By: Atanu Datta**

He likes to head bang and play air guitar in his spare time. Oh, and he's also a part of the LFY Bureau.





Niyam Bhushan

# How To Melt Down

Start with professional qualifications.

Nobody has said it yet: The global financial crisis is hand-crafted by highly-educated people. Most of them armed with post-graduate and professional degrees from reputed universities of the world. Some may be armed with an MBA with a specialisation in finance. Others awarded with some of the most prestigious degrees and qualifications in economics, commerce, and/or finance. They did not just pull wool over the eyes of the world one impetuous morning. No sir, they toiled and wrought and worked hard on this debacle for decades.

## Figure this

These white-collared criminals have plundered the cumulative wealth of the world in hundreds of billions of dollars, and robbed ordinary folks of their savings and jobs. Has anyone noticed the rich and industrialised nations of the world have ended up needing more aid than has ever been given to poor Africa?

The uneducated are limited due to their lack of qualifications, to relatively-smaller financial crimes. Among these are shop-lifting, pick-pocketing, or at worse, kidnapping, and more recently, hijacking ships off Somalia. The formidable Indian Navy steams in, cannon-guns blazing, to sink those Somali Johnny Depps come lately. In shameless contrast, white-collar criminals get governments to pick the tab. How come an increasingly expensive education system forgot an entire chapter on basic human values? Exactly where did the education systems of the world go wrong?

## Cheat questions

I found myself asking these questions while countless parents in India bunked work to stand in queues, paying hefty donations and bribes, to get their toddlers admitted to school. How ironic. In the charade of education, stern-looking principals asked: "What are your aspirations from your child?" I wonder which parent had the wit to answer: "Oh! I'd be proud for my girl to become a global financial analyst so she can siphon off billions of dollars and bring capitalism to its knees. Do you have special coaching classes to nurture her at an early age? I'll pay you the bribe for her admissions. It's worth the investment."

## Value-deducted education

Nobody's keenly asking the Indian education system about the values they'll inculcate in children. Most parents are


only interested to note whether the school's centrally air-conditioned; and whether it boasts a computer lab with Wi-Fi and broadband. No one's paused to ask whether they use GNU/Linux and FOSS, whether the syllabus and the courseware is *muft* and *mukt*, or even if the school's open to explore such fundamental ideas. An education system built on proprietary education is deeply flawed and wounded. It teaches children that sharing with a neighbour or a friend is a bad thing. Students and teachers may soon be encouraged to rat upon their colleagues' use of unauthorised software and courseware to reap rewards in return.

Young minds are not ignited to share their knowledge and education by contributing to *muft* and *mukt* courseware. Instead, every quarter, a chunk of each child's school fees

will go into paying for proprietary software and courseware peddled to a captive audience. In some cases, the courseware may have been authored by sincere teachers paid a one-time and small pittance, or authors who once received their education and knowledge in their growing years, in the true spirit of sharing.

**"An education system built on proprietary education is deeply flawed and wounded."**

## Blame game

Superficially, it may seem ridiculous to partly blame the meltdown on a lack of *muft* and *mukt* software and education. But this is not about tools and pedagogies. This is neither about saving costs. This is about deeply examining what's gone wrong with education. This is about exploring cultural values that education seems to have forgotten to impart. All these values come abundantly with the *muft* and *mukt* vision of FOSS. The only priceless thing a school may impart your child, are good human values. The adoption of a *muft* and *mukt* vision is its first yardstick. If a school can't appreciate this fundamental principle of knowledge, everything else may well be flawed. I'm doing my bit to melt down the rotten system of proprietary education today, through activism and direct involvements with academia. Everybody pitch in. We can bring about an even bigger melt down. **END** 

## About the author:

Inspired by the vision of Osho. Copyright September 2008: **Niyam Bhushan**. [freedomyugs@gmail.com](mailto:freedomyugs@gmail.com). First published in LinuxForYou magazine. Verbatim copying, publishing and distribution of this article is encouraged in any language and medium, so long as this copyright notice is preserved. In Hindi, 'muft' means 'free-of-cost', and 'mukt' means 'with freedom.'

## Enabling Indian languages on the FOSS desktop Part 2

# The Little GNOME Stands Tall



The smirking little leprechaun—stands up to KDE, doesn't he, the spunky dwarf? As we will see, it takes a little more configuration than KDE, but GNOME users, too, can type on their desktops in their mother tongues. The nerve of the GNOME!

**K**DE users, beware. We're fast losing sniggering rights—if we ever had them—to GNOME. The dumb user's desktop environment, as we called it, stole a march on us with Orca, the blind-friendly screen-reader. Now, the SCIM application on GNOME is threatening to do so on the Indian-language front, particularly in the case of the Devanagari script—I can personally attest that it includes the additional letters that the Marathi script uses, which is an indicator. Now SCIM does have stability issues on some distributions, but the remedy is only a matter of time, and it's stable on the major distros—besides being as easy to use as KDE's keyboard tool. Where the GNOME application lags behind is that it requires the download of fonts and code before it can use Indian languages. Unlike most KDE distros, it isn't ready out-of-the-box. But this is easily solved.

### Downloading fonts

The process of downloading and installing Indian language fonts, indeed any fonts, differs from distribution to distribution. Mandriva does this from the Mandriva Control

Centre, and, in Ubuntu 8.10, which we've used for this article, this is as easily accomplished from the top panel menu thus: *System→Administration→Language Support*.

In the *Language Support* window that now appears, make your selection. Ubuntu should download the fonts and other files required. This can take a while, but the language support application shows you the download progress.

### Setting up SCIM

Next, as explained in the earlier article, you have to change your keyboard layout—the map of relationships between your keyboard keys and the alphabet. Use an application called the keyboard layout changer. The changer has a fancy name in GNOME: the Smart Common Input Method platform. You open it thus: *System→Preferences→SCIM Input Method Setup*.

The SCIM window should display a main panel with its name, and a side panel (Figure 1). This is where you will configure SCIM. From its side-panel, select *IMEngine→Global Setup*—which shows you a list of input methods in the main window (Figure 2). Select the method, or

methods, that you want from the profuse list. And save your changes, of course.

Now, for some more configuration to ease up your experience. From the SCIM application's side panel, select *IMEngine*→*Generic Table* (see Figure 3). The main window here should show you three tabs in a stack. Here, in the 'Generic tab', you'll see five options that you can toggle to have SCIM complete your words as you type, and display key combinations for your words. This feature is not available for all the languages you installed, and didn't work in my SCIM set-up, although was shown as installed in *IMEngine*→*Generic Table*→*Table Management* tab. Huh!

You can also configure keyboard shortcuts in this window. A tip: if you must use them, do change the defaults that involve the *Ctrl+Shift* key combination—it conflicts with the paragraph selection shortcut of OpenOffice.org.

Finally, when you use SCIM, it'll display the SCIM ToolBar. This bar floats in the bottom right corner of your desktop, displaying the active layout. You can choose to turn this off if you like—*Panel*→*GTK*→*ToolBar*→*Show:Never* option.

We're now done configuring. Take a look at the tray of the panel on the top edge of your desktop. You'll see a keyboard icon there. That's the SCIM switcher. Click once on it to see the list of language layouts you chose earlier. Choose your language from the list. And you're ready to begin typing in your word processor or text editor.

## The layouts

When you enable Indian language support in SCIM, you currently get eight Indian languages—Kannada, Telugu, Malayalam, Bengali, Gujarati, Hindi, Punjabi and Tamil. For the last five languages, you also have phonetic layouts (Hindi also includes Marathi). The phonetic layout is best for most users, as explained last month, while for very long sessions you would prefer the more ergonomic non-phonetic layouts. In Hindi, the non-phonetic users can choose between the Inscript and Remington layouts. These layouts are also available in KDE, by the way, so there's nothing to choose between the two desktops here.

In GNOME's SCIM, though, the Devanagari phonetic layout is—I hate to admit—better in at least some languages than KDE's Bolnagri, because it includes the 'Lla' (press *Shift+L*), and 'dnya' (*Shift+6*) alphabets as used in some Devanagari scripts such as Marathi. A difference of style from KDE's Bolnagri is that, in the SCIM input here, the key F is used to join two alphabets together. So, for example, the name Partha, which includes the r-th sound, is produced thus: p+a+r+f+[shift+T]. Easy enough!

What's more, there is yet another phonetic layout under development, primarily on the Ubuntu-India forum. I tried finding the source and installing it, but couldn't. It is said to mimic the layouts used by Baraha (the very competent and free-for-use, but sadly closed-source, Windows word processor). See if you can locate the source. You'll have to download and compile it in your terminal and configure it



Figure 1: SCIM main screen

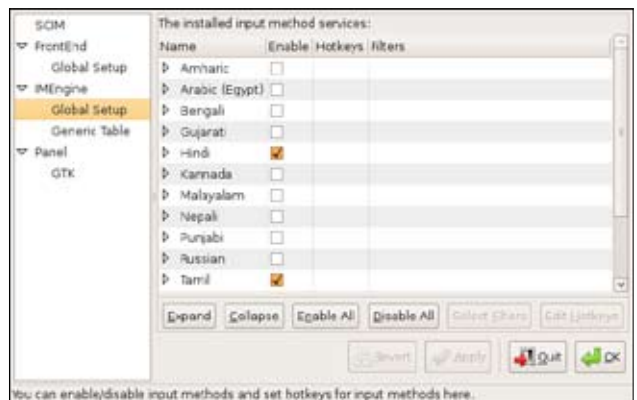


Figure 2: A list of input methods

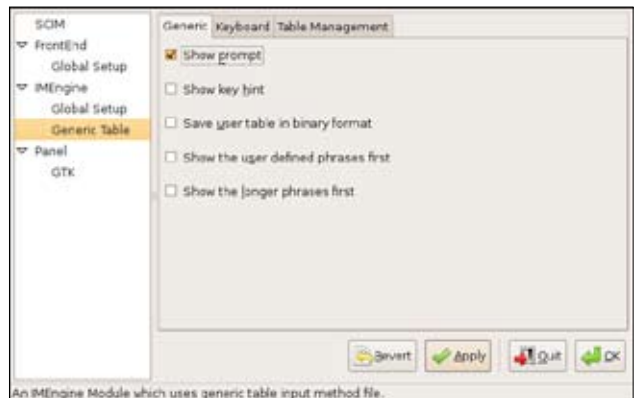



Figure 3: Some useful settings

through a short and easy, though manual, process.

## Sign-off

GNOME's undoubtedly superlative accessibility features are almost matched by its increasing competence in Indian language support through SCIM. Time was when you either loved or hated GNOME—but it'll soon be pretty difficult to do the latter. **END** 

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## Programming in Python for Friends and Relatives: Part 9

# Scripts

## for Home Network

Some nifty scripts to check remote systems over the Internet.

Thanks to broadband, most homes have a computer network. However, I often get a call from my parents on how their computer is not working. This, in their minds, is the root cause for a vast variety of issues they face. Wouldn't it be nice if I could just sign into their computer and examine the problem? Do you know that with the availability of 'broadband', this is, indeed, viable?

Python has excellent modules for network programming—the key modules are `socket` and `threading`. However, to monitor a network, you will need to write small scripts for specific tasks and not worry about the intricacies of network programming. So, you can feel confident about encouraging your relatives to switch to Linux *and* offer support to them remotely!

To log in to a remote computer, you will need to know its IP address. On a broadband connection, the IP address is typically not fixed. Once your script finds the IP, you have to be informed of it. The easiest way is for the script to mail it to you.



**Note:** The code I'll present has been tested on Fedora 9, but should work unchanged on Ubuntu and most other distributions as well.

### Finding the IP address of the machine

Let us suppose the broadband modem is connected using the *pppoe* protocol, which is easier to handle. In this case the public IP is on the local system. You can find that out by using the `/sbin/ifconfig` command. You should see an entry like *ppp0* in addition to entries for *lo* and *eth0*. You are interested in the *ppp0* entry and, in particular, the line

related to the 'inet addr' entry. So, here is our little script using the versatile `subprocess` module added in Python 2.4:

```
from subprocess import Popen, PIPE
def get_ip():
    proc = Popen(['/sbin/ifconfig', 'ppp0'], stdout=PIPE, stderr=PIPE)
    output = proc.communicate()
    if output[1] != '':
        response = 'Error: ' + output[1]
    else:
        response = [line for line in output[0].split('\n') if 'inet addr:' in line]
    return str(response)
print 'The IP is ', get_ip()
```

The above script opens a pair of pipes to the *ifconfig* command and passes 'ppp0' as a parameter. The *communicate* method returns a tuple for the *stdout* and *stderr* of the command. In this

instance, if you find that *stderr* is not empty there must have been an error; otherwise, you split the *stdout* on a new line and select the line containing the IP address.

A second possibility is that the modem is set up as a router. So, the external IP is on the router. The home models come with a Web interface to the modem. You can call the relevant page using



the following script and then access the data:

```
from sgmllib import SGMLParser
class selector(SGMLParser):
    def reset(self):
        SGMLParser.reset(self)
        self.data = []

    def handle_data(self, data):
        if data.count('.') >= 3:
            self.data.append(data.strip())

import urllib
def get_data(url):
    page = urllib.urlopen(url)
    parser = selector()
    parser.feed(page.read())
    parser.close()
    return parser.data

def get_ip():
    url = 'http://admin:password@192.168.1.1/hwhtml/summary/sum.html'
    return str(get_data(url))
```

The ideas behind the above code were discussed in last month's article on the subject. In the parser, we wrote a trivial method to extract any data that looks like a URL. The base URL is for a Huawei modem supplied by BSNL. The user name and the password can be passed as a part of the URL. The resulting output will look like what's shown below:

```
['D57.2.17', '59.94.245.130', '59.94.240.1', '255.0.0.0', '192.168.1.1', '255.255.255.0']
```

In this case, the external IP address for the modem is 59.94.245.130. This is followed by the IP address of the gateway and the netmask.

By the way, in the last article, we had used *urllib2*. Authentication handling is a little more complex and flexible using *urllib2*; so, the above code used *urllib* instead and saved about five lines of code. In case you would like to explore authentication using *urllib2*, see [www.voidspace.org.uk/python/articles/authentication.shtml](http://www.voidspace.org.uk/python/articles/authentication.shtml).

## Sending the IP address by e-mail

Since Gmail is very common, let us use that as the example to send the IP address to yourself. Here is the script you will need to write:

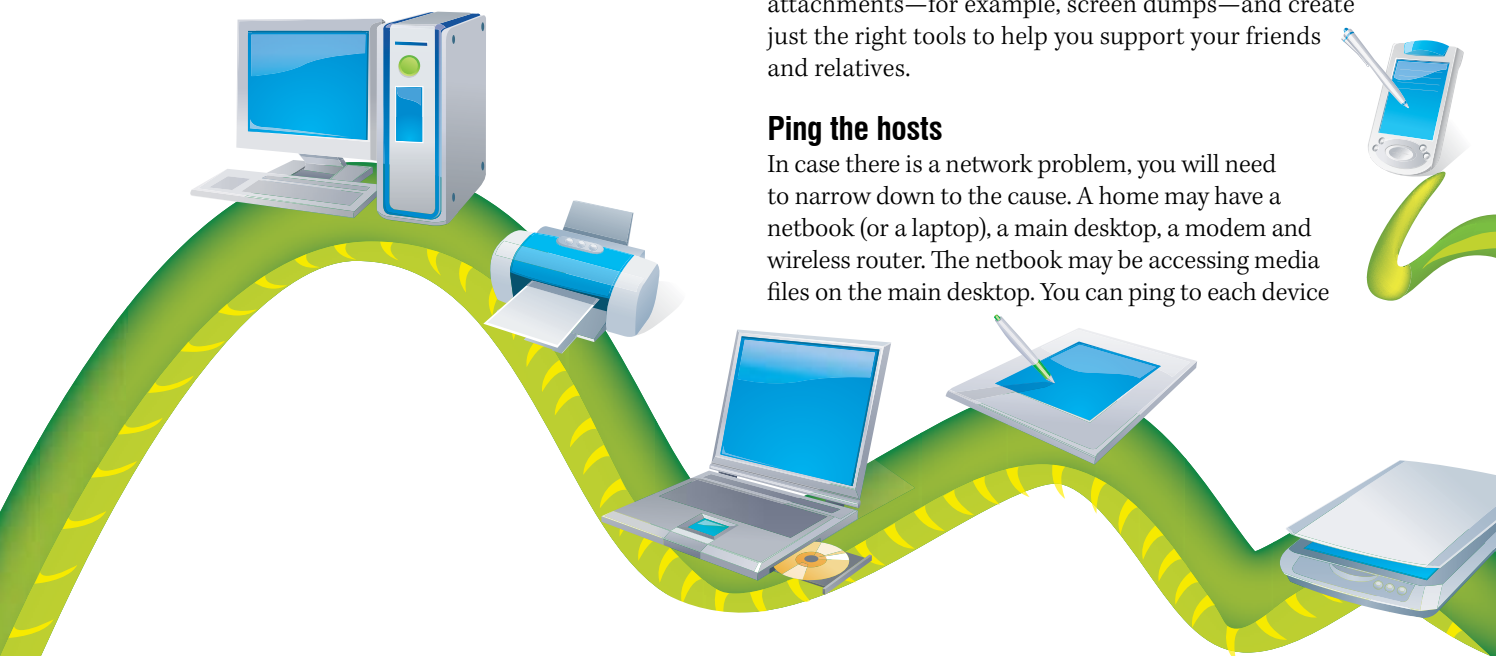
```
import smtplib
recip = 'youremailid@yourdomain'
gmail_user = 'family.member@gmail.com'
gmail_pw = 'password'
smtpserver = smtplib.SMTP("smtp.gmail.com",587)
smtpserver.ehlo()
smtpserver.starttls()
smtpserver.ehlo()
smtpserver.login(gmail_user, gmail_pw)
hdr = ""To: youremail@yourdomain
From: family.member@gmail.com
Subject: IP Address
""
msg = hdr + '\n' + get_ip() + '\n\n'
smtpserver.sendmail(gmail_user, recip, msg)
smtpserver.close()
```

You use the Python module *smtplib*. Gmail requires a secure connection and that the sender be authenticated. The complete message consists of a header with a blank line separating it from the message text. The text content is added by calling one of the *get\_ip* methods you have written above.

You can use the *email* module to send mime attachments—for example, screen dumps—and create just the right tools to help you support your friends and relatives.

## Ping the hosts

In case there is a network problem, you will need to narrow down to the cause. A home may have a netbook (or a laptop), a main desktop, a modem and wireless router. The netbook may be accessing media files on the main desktop. You can ping to each device



to know if it is working. The advantage of the *subprocess* command is that you can start *ping* on each device without waiting for it to finish. You can use threads without the need to manage the complexity.

```
from subprocess import Popen, PIPE
# The addresses of localhost, the wireless router, the modem, the main
desktop
hosts = ['127.0.0.1', '192.168.0.1', '192.168.1.1', '192.168.0.100']
procs = []
for host in hosts:
    procs.append(Popen(['ping', '-c2', '-i', host], stdout=PIPE))
for proc in procs:
    proc.wait()
for proc in procs:
    print proc.communicate()[0]
```

Create a list of devices/hosts in which you are interested. You then start a *ping* process for each of the hosts, with parameters limiting the number of times you *ping* while reporting only the summary information. Next, you wait for each process to get over and then process the results. If successful, you will see an output like the following:


```
PING 127.0.0.1 (127.0.0.1) 56(84) bytes of data.
--- 127.0.0.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1008ms
```

```
rtt min/avg/max/mdev = 0.083/0.102/0.122/0.021 ms
```

While for an unsuccessful case...

```
PING 192.168.0.100 (192.168.0.100) 56(84) bytes of data.
--- 192.168.0.100 ping statistics ---
2 packets transmitted, 0 received, +2 errors, 100% packet loss, time 3001ms
```

The nice thing about scripts is that you can keep adding them to your armoury as and when you come across problems. For example, even though the disk capacities are very large, a partition may still run out of space. It can be very hard to figure out why some applications or even the GUI desktop just refuses to start. Unresponsive or erratic DNS servers can create a frustrating browsing experience.

Scripts that monitor the systems can help you prevent problems before they arise, while sitting anywhere in the world with just a network connection. The downside is that your relatives may not realise your contribution or utility! This can be a serious issue in the corporate environment, but you can always write scripts so that your presence is indispensable—for example, by converting your scripts to one of the write-only scripting languages! 

By: Dr Anil Seth

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# *Sniff! Sniff!!* Who Clogs My Network?

Some network connectivity and troubleshooting tools.

*W*hat do you do when you've just set up a network and the basic stuff is all fine, but something is still wrong. For instance, you're able to ping one host, but not another? Or connectivity to some sites is slow, though to most other sites it appears to be fast enough, and your ISP say it's not their headache?

In this article, we'll run through some of my favourite tools for network troubleshooting. If you're a network admin, you might find these tools useful. However,

I have tried, as usual, to favour concepts and description over detailed command information, so even a normal home user might find this article interesting as a casual read. I expect anyone with a serious interest in one of the tools to check out the *man* pages or other documentation anyway.

## **All at sea**

I'm an avid quizzier, as I'm sure some of you are. I sometimes conduct quizzes too, and one of my favourite questions is: what is the connection between the

Sonar equipment used in a submarine and modern networking? Of course, it's the humble *ping* command, which was named after the sound that a Sonar makes in a submarine. If you've seen *Hunt for Red October* you'll know :-). So, continuing the marine theme, *ping* is the first port of call when you have a network problem, and naturally, everyone knows how to use it to check if some host is up.

But is that all *ping* can do? Even in the normal run, there's important information. Figure 1 shows a typical ping output.

There's a very important number that *ping* shows, called the 'round trip time' (RTT). RTT is a measure of how close a host is to you, based on how long it takes a packet to go out and come back again. RTT on a LAN tends to be less than a millisecond, while 2-3 milliseconds (as in Figure 1) is more typical of a wireless network. RTTs on WAN links are more in the 200-600 millisecond range, reflecting the number of routers that they have to go through.

Ping can also get you clued into an unreliable connection, by showing a packet loss in the status line (the last line but one above). For instance, it might say "50 packets transmitted, 47 received, 6% packet loss, time 44754ms," which would indicate a pretty bad connection.

But this information only shows up at the end, after you kill *ping*. What if you want to keep the ping running for a while and continuously see how reliable the connection is? Well, you can watch the ICMP sequence number to make sure it increases exactly by one and doesn't skip a few, but that's too tedious to keep up for a long time. I mean, that's what computers are for, right—to do the tedious stuff? So can the humble *ping* command do anything more?

Turns out it can, and in a very imaginative and simple way! The command to use is *ping -f -i 1 host*. With the *-f* option, ping prints a "." for every outgoing packet and a back-space for every reply. Thus the number of dots on the display is the number of ping packets that have not yet been acknowledged by the remote side. A fast and reliable connection will not show you a single dot—every dot will be cancelled by a back-space well before the next dot appears, so the cursor sits on the left of the screen and nothing seems to be happening.

If you see the number of dots increasing gradually, you know there are packet losses happening on the link. It's actually a pretty cool display, but in order to see it, you have to test it against an unreliable server or an unreliable network. For most home users, the best way to do this is to use a laptop to ping a wireless router, and gradually move the laptop further and further away from the access point.

When you use *-f*, don't forget the 1-second interval flag (*-i 1*). Otherwise, you get what is called a 'flood

```
16:27:36 s1ta-wd:~ $ ping 10.0.0.1
PING 10.0.0.1 (10.0.0.1) 56(84) bytes of data:
64 bytes from 10.0.0.1: icmp_seq=1 ttl=64 time=1.56 ms
64 bytes from 10.0.0.1: icmp_seq=2 ttl=64 time=2.51 ms
64 bytes from 10.0.0.1: icmp_seq=3 ttl=64 time=2.65 ms
64 bytes from 10.0.0.1: icmp_seq=4 ttl=64 time=2.32 ms
64 bytes from 10.0.0.1: icmp_seq=5 ttl=64 time=2.52 ms
^C
--- 10.0.0.1 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4477ms
rtt min/avg/max/mdev = 1.567/2.316/2.653/0.391 ms
16:27:37 s1ta-wd:~ $
```

Figure 1: The output of a ping command

```
atocall.atc.tcs.com (0.0.0.0) My Traceroute [v0.72] Fri Dec 12 16:35:56 2008
Keys: Help Display mode Restart statistics Order of fields Quit
Packets
Host Loss% Last Avg Best Wrt StdDev
1. 203.200.212.1 0.0% 0.3 0.3 0.3 0.3 0.0
2. 171.241.176.14.static-hyderabad.vsnl.net 0.0% 21.3 16.0 0.0 23.7 7.9
3. 111hyd-203.199.191.26.static.vsnl.net.i 25.0% 23.5 9.6 2.0 23.5 12.0
4. 59.163.16.1.static.vsnl.net.in 50.0% 109.1 84.1 59.0 109.1 35.4
5. 59.163.16.1.static.vsnl.net.in 0.0% 19.3 63.0 19.3 150.5 59.3
6. 59.163.55.213.static.vsnl.net.in 0.0% 129.9 124.2 129.9 129.8 3.9
7. 59.163.16.229.static.vsnl.net.in 0.0% 88.5 96.8 88.5 126.3 26.2
8. 125.21.167.98 0.0% 133.1 125.3 137.0 133.1 8.0
9. 59.145.0.65 0.0% 117.0 121.6 115.5 130.5 6.8
10. 125.21.167.74 0.0% 142.2 136.0 129.0 142.2 6.2
```

Figure 2: An example mtr output

ping', which can look like a Denial of Service attack to the target host, and they might complain (or worse, retaliate). In fact, a fast machine on a fast network can bring down a network using a flood *ping* without an interval specified! However, if the target host is yours or you have permission to do so, it can be fun to try something like *ping -f -c 500 -s 1400 host*. The laptop + wireless method of simulating a flaky connection is really useful to see this in action. Also, try different values for the packet size (the *-s* option).

This is not just fun—you'll start to recognise that this simple dot pattern can clue you into troublesome connections very quickly, although once again, I must repeat that *-f* without *-i 1* should be used very carefully and sparingly, and only on your own hosts.

## Who's dropping the ball?

So you have a flaky connection to your office network... and your VPN keeps dropping off. Or your YouTube feed is constantly stopping to buffer; I mean, we know which is more likely, right?

A flood *ping* tells you there are lots of dropped packets but doesn't tell you where or who's responsible. If you've ever done a *traceroute*, you know there are multiple hosts in between yourself and the target, and it may be useful to know where among these hops the packet loss is occurring.

This is what *mtr* shows you: it shows where the packet loss is happening, in real time, using ICMP ECHO requests (i.e., ping packets). It's one of the best tools for figuring out where the problems are, with a simple but really useful display, including a quick online help screen. The default screen looks like Figure 2, once it's started up, though, of course, it's continuously updating.

You can quickly see which intermediate router





this sort of information, there is another tool that has become a very useful part of my toolkit now, which is called *iftop*. It's a pretty old tool, and it hasn't been updated in a couple of years, but don't let that stop you from trying it.

*iftop* is an interactive program with a number of cool features, all of them accessible by typing some key, and it has a quick 1-screen online help in case you forget the keys. Running *ifopt -nNPB* on a lightly-loaded system might look like the output shown in Figure 5.

The display is quite self-explanatory, except for the last three columns in the main display. These are averages of the data transferred over the previous 2, 10 and 40 seconds respectively.

The black bars are important. Across the very top is the 'scale' for all the bars, and the bars actually represent the 10-second average (the middle column) by default, although pressing "B" will cycle between 2, 10, and 40-second averages. This way you get a visual indication of what hosts and ports are hogging the traffic.

You can do some cool things here—you can choose to look only at outgoing or incoming traffic or perhaps the sum of the two (press *t* to cycle between these modes). You can aggregate all traffic for each source into one line by pressing *s*, and for each destination by pressing *d*. Be sure to read the online help as well as the man page -- it's worth it.

What's even more cool is that there are two filters to limit the output. Typing *l* enables a 'display filter'—the pattern or string you enter will be applied to the host+port field and used to filter lines appearing in the display. This is a literal match: for example, if you type "pop3" as the search filter, then use "N" to disable port number resolution, you'll have to change the search string to ":110" in order for it to match. The same goes for host names versus IP addresses.

Using *l* only affects the display; the totals still count all the traffic. On the other hand, you can use *f* to set a packet filter condition that will stop traffic that does not match, from even coming into the program. For instance, you can type "f" then "port 25" to see only SMTP traffic. This filter can take quite complex conditions, using the same syntax that popular tools

like *tcpdump*, etc, use. Plus, this filter can be specified from the command line too, like:

```
iftop -nBP -f 'port 22'
```


All in all, this is a pretty nice tool to keep an eye on things once in a while or perhaps when someone complains things are a little slow.

*iptraf* is also a very nice and easy-to-use tool, with a very neat curses GUI. It actually has a lot more features than *iptraf*: the IP interface monitor shows you TCP and UDP separately, and for TCP it shows you packet flags (making it easy to identify connection attempts that are not succeeding, for instance). Overall statistics for each interface are also available in a separate screen, and on the whole it's almost a real GUI (using curses), with menus and sub-menus, etc. It also has a very slick filter specification GUI, if you're not the command line type.

Despite all this, however, I find myself using *iftop* for day to day use, because *iptraf* lacks the aggregation, multiple averages, quick and easy filtering, etc, that *iftop* does. Plus, most of the filters I want are much easier to type into *iftop* or at the command line.

## Some last words

I don't use these tools every day, but when I needed them, they were really useful. Could I have gotten by without knowing them? Maybe... but that's not how we think, is it? A workman needs as many tools as he can get his hands on, and these are some of mine.

Among these, *iftop* remains the one I use more often than the others. It's actually closer to monitoring than troubleshooting, but they're all great tools, and exploring them gives you an understanding of what's happening under the hood as your machine goes about its daily business. 

By: [Sitaram Chamarty](#)

The author has a 'packrat' mentality when it comes to finding and learning about all sorts of tools, both well known and obscure. He 'carries' these tools around with him on a small USB stick, thanking God every day that he is not, for instance, a carpenter :-). Sitaram works for TCS, in Hyderabad, and can be reached at [sitaramc@gmail.com](mailto:sitaramc@gmail.com)

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# It's So Easy to See Your Network Activity, hah!



Just because you're using a WEP key on your wireless access point doesn't mean you're safe from crackers in the neighbourhood.

A sniffer is basically a network analyser. Likewise, a wireless sniffer is software that can analyse the traffic over a wireless network. The data thus obtained can be used for various purposes—debugging network problems, for instance. These tools can also grab all the non-encrypted data from the network, and hence can be used to crack unsecured networks. This is one of the major reasons why sniffers are a threat to networks.

Detecting the presence of such sniffers is a challenge in itself. On the other hand, you can use these tools to analyse your own networks and check the extent to which they are secure against threats. You could say that the sniffers give you an X-ray view of your network.

Sniffers provide real-time packet data from local, as well as remote machines. Some network analysers even have the ability to alert you of potential developing problems, or bottlenecks that are occurring in real-time. Some have the capability of capturing packet streams and allow you to view these packet streams and edit them.

There are many such sniffing software available on Linux, UNIX, BSD, Windows, etc. Most of the commercial software is quite costly. That, and the fact that I hate Windows, means I will be using one of the popular free software under Linux for sniffing wireless networks and to crack a WEP protected network.

This article is only for educational purposes and I will

be demonstrating the use of sniffers by trying to crack my own wireless network. I will not be liable for any criminal act committed by the reader.

## Basic networking information

You will need to know some basics of computer networking in order to fully understand the working of a sniffer tool. Every network device has a MAC (Media Access Control) address. Let's consider a wireless network and, say, four different wireless network cards in its proximity that are connected to that network. The wireless network simultaneously transmits data for all four cards (four computers with wireless networks). Data for each network card is recognised by the MAC address of the corresponding network card. Generally, a network card only receives the data designated for its MAC address. However, when a card is put into what is known as a 'promiscuous mode', it will look at all of the packets being transmitted by the wireless network.

Wireless networks are not the same as cable networks. All computers can access all the data, but generally, they ignore all available data except for the ones designated for them. However, they no longer ignore the data when in 'promiscuous mode', which is the basic feature of sniffing.

There are mainly two methods to achieve this. One is where you connect to the WAP (wireless access point) using your computer to receive all the traffic transmitted



by it. In this mode, you need to know the password for the network in order to connect to the WAP. In the second method, known as the monitor mode, you do not have to connect to the WAP to intercept the data; yet you can monitor all the traffic.

However, these modes are not supported by all the wireless network cards. For example, Intel's 802.11g cards do not support the 'promiscuous mode'. The monitor mode also needs to be supported by the card. The advantage of the monitor system (from a cracker's perspective) is that it does not leave any trace on the WAP—no logs, no transfer of packets to the WAP or directly from the WAP.

## Wireless sniffing: a case study

Sniffing wireless networks is more complicated than sniffing wired networks. This is mainly because of the various encryption protocols used. If you want to sniff a network with Wired Equivalent Privacy (WEP) security then it is fairly easy. In fact, it has been proved many times that WEP can be easily cracked (as will be shown later in the article). Sniffing/cracking networks with Wireless Protected Access (WPA) security, however, is not so easy.

The difference in WPA and WEP is that WEP applies a static method to use pre-shared keys for encryption. It uses the same key to encrypt all the data. This means a large number of packet transfers with the same key, which makes cracking easy. Second, one has to manually update all the client machines when a WEP key is changed on the network. This is not practical for large installs. WPA, on the other hand, uses the pre-shared keys to derive a temporary key, using which all the traffic is encrypted. So, WPA generates a unique key for each client and access point link. Moreover, the pre-shared key is very rarely used, making it difficult for sniffers to crack the key. I would like to make one point clear here—one can crack WPA passwords if they are too simple. This is not a flaw in WPA, but in the network manager who sets the weak password.

We will now see how to sniff a wireless network with WEP security and use the sniffed packets to crack the password.

For this study, I will be using two laptops. One running a Live CD of BackTrack Linux 3 and the other running Windows XP. The Windows laptop has access to the WAP. The user knows the key. He is using the Internet on his laptop. I (the cracker) am using the laptop with BackTrack Linux. There are many popular wireless sniffing and key sniffing tools available for Linux like Air Snort, Air Crack, WireShark, etc. I decided to go with Air Crack. (For an extensive list of all the tools, please visit, [backtrack.offensive-security.com/index.php?title=Tools#Radio\\_Network\\_Analysis](http://backtrack.offensive-security.com/index.php?title=Tools#Radio_Network_Analysis)).

Remember, not all cards support monitor mode, which is what is being used here to crack the password. I am not going into the details of how to install Air Crack (or any other tool) in this article. I assume that you already have the software. In order to carry out attacks on wireless networks efficiently, you'll almost certainly need to patch your wireless drivers to support packet injection—the

```
bt ~ # iwconfig
lo          no wireless extensions.

eth0        no wireless extensions.

eth1        unassociated  ESSID:off/any
            Mode:Managed Channel=0 Access Point: Not-Associated
            Bit Rate:0 kb/s Tx-Power=20 dBm Sensitivity=8/0
            Retry limit:7 RTS thr:off Fragment thr:off
            Encryption key:off
            Power Management:off
            Link Quality:0 Signal level:0 Noise level:0
            Rx invalid mid:0 Rx invalid crypt:0 Rx invalid frag:0
            Tx excessive retries:0 Invalid misc:0 Missed beacon:0

bt ~ #
```

Figure 1: A typical iwconfig output

```
bt ~ # airmon-ng start eth1

Interface      Chipset      Driver
eth1           Centrino b/g ipw2200 (monitor mode enabled)

bt ~ #
```

Figure 2: Starting the monitor mode

patches as well as details of how to do this can be found at [www.aircrack-ng.org/doku.php?id=install\\_drivers](http://www.aircrack-ng.org/doku.php?id=install_drivers).

BackTrack Linux comes with pre-patched drivers and is a very good distribution for hacking purposes. The driver being used in this experiment is 'MadWiFi'.

Now you can check if your card supports monitor mode by issuing the following command as the root user (from here on, all the commands are issued as the root):

```
iwconfig
```

This will give you the name of your wireless network card (Figure 1). Once you get that, issue the following:

```
airmon-ng stop eth1
```

You can replace 'eth1' with the name of your wireless network card device.

Then execute the following command to make eth1 work in 'monitor' mode (Figure 2):

```
airmon-ng start eth1
```

Now scan for wireless access points by issuing the following command:

```
airodump-ng eth1
```

As you can see in Figure 3, this will show you any networks detected, the MAC addresses of the access points (BSSID), the MACs of any computers that are connected to them (STATION), and the Wi-Fi channels they are operating on. If the access point is broadcasting its name (ESSID), this will also be shown.

Once you have got this information, you can try and crack the key. Note the channel of the WEP encrypted network in Figure 3—it is 6. Quit *airodump* by pressing Ctrl+C and then issue the following:

```
CH 3 ][ Elapsed: 4 s ][ 2008-12-15 22:57
```

BSSID	PWR	Beacons	#Data	#/s	CH	MB	ENC	CIPHER	AUTH	ESSID
00:0F:A3:4C:F9:3D	213	26	15	7	6	54	WEP	WEP		MT841

BSSID	STATION	PWR	Rate	Lost	Packets	Probes
00:0F:A3:4C:F9:3D	00:1F:3C:63:E9:04	223	54-54	0		15

Figure 3: Scanning the wireless access points/capturing packets

```
bt ~ # aireplay-ng -3 -b 00:0F:A3:4C:F9:3D -h 00:1F:3C:63:E9:04 eth1
The interface MAC (00:16:0F:3F:06:70) doesn't match the specified MAC (-h).
ifconfig eth1 hw ether 00:1F:3C:63:E9:04
23:03:00 Waiting for beacon frame (BSSID: 00:0F:A3:4C:F9:3D) on channel 6
Saving ARP requests in replay_arp-1215-230300.cap
You should also start airodump-ng to capture replies.
Read 357 packets (got 0 ARP requests and 44 ACKs), sent 0 packets...(0 pps)
```

Figure 4: Injection of traffic onto the network using aireplay

```
bt ~ # aircrack-ng -z mycapture-01.cap
Opening mycapture-01.cap
Read 91704 packets.

# BSSID          ESSID          Encryption
1 00:0F:A3:4C:F9:3D MT841          WEP (47911 IVs)

Choosing first network as target.

Opening mycapture-01.cap
Attack will be restarted every 5000 captured ivs.
Starting PTW attack with 47937 ivs.
KEY FOUND! [ CD:12:3A:B4:56 ]
Decrypted correctly: 100%
```

Figure 5: Your WEP key is cracked, Boss!

```
airodump-ng -c X -w mycapture eth1
```

Replace the X with the channel number of your access point (6, in my case). This will start capturing the data that you will use to crack the WEP key, in a file called *mycapture-01.cap* in your home directory. You will see packets being gathered by the tool. Make sure you get at least 40,000 packets, good enough for more than 50 per cent of the cases. In case of a very strong password, go for 100,000 packets or so, making the efficiency (chance of cracking the key) close to 99 per cent.

Now we need to inject some traffic on the network. We can do so using the *aireplay* tool as follows. Note the MAC address of the base station and the client from the *Airodump* window. Now open a new root terminal and issue the following command:

```
aireplay-ng -3 -b 'base station MAC address' -h 'client Mac address' eth1
```

The -3 tells *aireplay* to search for ARP (Address Resolution Protocol) requests and replay them. Once the request is received, the injection of packets will begin. *Airodump* will start collection packets in *mycapture-01.cap* file (see Figure 4).

The work is almost done at this point. All you have to do now is issue the following command in the third terminal window, and you will get the password 95 per cent of the times (depending on the number of packets you have collected. If it fails, retry with more number of packages).

```
aircrack-ng -z mycapture-01.cap
```

In a couple of minutes, you will see the network key as shown (Figure 5). The key in this case is 'CD123AB456'—a hex-64bit WEP key.

## How to secure your network


As can be seen from the example above, sniffing wireless networks with a WEP key (or no encryption) is fairly easy. The protocols *telnet*, *pop3*, *imap*, *ftp*, *snmp*, and *nntp* are more susceptible to cracking as they transfer the passwords in plain text while authenticating. Once a cracker gets hold of your key, he can sniff all the data to and from your network. Even if you use secure protocols, only the password and username are encrypted and not the actual data.

You can make your networks less vulnerable to sniffers and play sniffing to your advantage. As already said, a network administrator *must* try and sniff his own network to check its immunity to such attacks. It can be used to strengthen the network and debug it whenever necessary. To make the attacks less damaging, the only sane remedy is to use strong encryption. Again, some protocols do not support password encryption, so you must always sniff your own network to see if any password and/or other sensitive information is left non-encrypted. Of course, you should use more secure keys such as WPA or WPA2 for your networks.

One more thing to take care of is changing the default password of your WAP. Most routers come with default username/password combinations like admin/admin or admin/password. Change it and use a strong password. You can turn off the SSID broadcasts of your WAP. Broadcasting SSID makes setting up wireless clients extremely convenient since you can locate a network, without having to know what it's called, but it will also make your network visible to any wireless systems within range of it (as shown in the demo above, we are using the SSID of the station (BSSID)).

You can enable MAC address filtering so only the devices with allowed MAC addresses can access your WAP. (Remember, the MAC address is unique for a device, just like a fingerprint.) Even MAC addresses can be spoofed once known, but this is still better than using no filtering at all.

## Where do we stand?

There are many sniffing tools available on Linux, UNIX and the Windows platforms. Most of these can be used to sniff packages and then try and crack the passwords of the networks. The only way to avoid damage is to use preventive controls. Follow the steps given above to secure your network. Do not fear sniffing tools. Use them to your advantage and try cracking your own network to see how secure you are... 

By: Aditya Shevade.

National Talent Scholar, Aditya Shevade, a third year electronics engineering student, takes keen interest in programming and electronic design. A Linux user for past two years, he enjoys playing keyboard and is a good photographer. To know more about him, visit [www.adityashevade.com](http://www.adityashevade.com)





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# Graph Your Network!



Graphs always make work easier, especially when we need to monitor things. In this article, we'll discuss Cacti, a simple graphical network monitor.

At some time or the other, many of us have felt the need to monitor different statistics regarding the machine connected to our network. SNMP (Simple Network Management Protocol) provides a standard set of network management tools to do so. Another useful tool is RRDTool, which is supposed to be an open source industry standard – a high-performance data logging and graphing system for time series data. Both these tools are really powerful and provide a base for many projects. One such project we will take a look at in this article is Cacti.

## What is Cacti?

Cacti, according to the project website, is “a complete network graphing solution designed to harness the power of RRDTool's

data storage and graphing functionality. Cacti provides a fast poller, advanced graph templating, multiple data acquisition methods, and user management features out-of-the-box. All of this is wrapped in an intuitive, easy to use interface that makes sense for LAN-sized installations up to complex networks with hundreds of devices.” Figure 1 shows a preview of Cacti graphs.

With a PHP-driven front-end, Cacti has the ability to store the required information to create the graphs and populate them with data in a MySQL database. Apart from the ability to maintain graphs, data sources, and round-robin archives in a database, Cacti can even handle data gathering. As for those who want to create traffic graphs with MRTG (Multi Router Traffic Grapher), there is the obvious SNMP support. For a complete list of important features, take a look at the box.

## Features of Cacti

The website has a complete section dedicated to Cacti's feature set. We have reproduced the content here for your reference.

### Graphs

- It allows you to create almost any imaginable RRDTool graph using all of the standard RRDTool graph types and consolidation functions.
- You can define an unlimited number of graph items for each graph, optionally using CDEFs or data sources from within Cacti.
- Automatic grouping of graph items allows quick re-sequencing of graph items.
- Auto-padding support makes sure the graph legend text lines up.

### Graph display

- The tree view allows users to create 'graph hierarchies' and place graphs on the tree. This is an easy way to manage/organise a large number of graphs.
- The list view lists the title of each graph in one large list, which links the user to the actual graph.
- The preview displays all the graphs in one large list format. This is similar to the default view for all CGI scripts for RRDTool/MRTG..

### Data sources

- Data sources can be created that utilise RRDTool's create and update functions. Each data source can be used to gather local or remote data to be placed on a graph.
- It supports RRD files with more than one data source and can use an RRD file stored anywhere on the local filesystem.
- Round robin archive (RRA) settings can be customised to give users the ability to gather data on a non-standard time span while storing varying amounts of data.
- It supports feeding paths to any external script/command along with any data that the user will need to 'fill in'. Cacti will then gather this data in a cron job and populate a MySQL database or round robin archives.
- Data sources can also be created, which correspond to actual data on the graph. For instance, if a user wants to graph the ping times to a host, you can create a data

source by utilising a script that pings a host and returns its value in milliseconds.

### Data gathering

- It contains a 'data input' mechanism that allows users to define custom scripts that can be used to gather data. Each script can contain arguments that must be entered for each data source created, using the script (such as an IP address).
- The built-in SNMP support can use `php-snmp`, `ucd-snmp`, or `net-snmp`.
- It has the ability to retrieve data using SNMP or a script with an index. An example of this would be populating a list with IP interfaces or mounted partitions on a server. Integration with graph templates can be defined to enable one-click graph creation for hosts.
- It also provides a PHP-based poller to execute scripts, retrieve SNMP data, and update your RRD files.

### Templates

- Templates allow the creation of a single graph or data source template that defines any graph or data source associated with it.
- Graph templates enable common graphs to be grouped together by templating. Every field for a normal graph can be templated or specified on a per-graph basis.
- Data source templates enable common data source types to be grouped together by templating. Every field for a normal data source can be templated or specified on a per-data source basis.
- Host templates are a group of graphs and data source templates that allow you to define common host types. On the creation of a host, it will automatically take on the properties of its template.

### User management

- User-based management allows administrators to create users and assign different levels of permissions to the Cacti interface.
- You can even specify permissions per-graph for each user. This makes Cacti suitable for co location situations.
- All users can keep their own graph settings for varying viewing preferences.

## Setting it up

The installation part is easy: it should be done from your distribution's software repository. If not automatically pulled in, you need to install Apache, MySQL, PHP, *php-mysql*, *net-snmp*, *php-snmp* and *rrdtool* as dependencies for Cacti. If you want to install the latest version of Cacti manually, you can find it on the downloads page of the project website at [www.cacti.net/download\\_cacti.php](http://www.cacti.net/download_cacti.php)

*Step 1—Configure SNMP(Optional):* Use the *snmpconf*

tool to create a basic set-up of SNMP for each host as follows:

```
snmpconf -g basic_setup
```

Check [net-snmp.sourceforge.net/docs/man/snmpconf.html](http://net-snmp.sourceforge.net/docs/man/snmpconf.html) for more information on it.

If you are using SNMPv3, you will have to create a SNMP user to allow read-write access as follows:

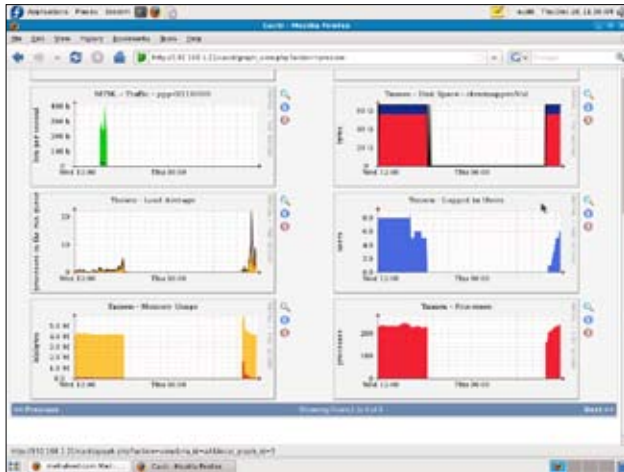


Figure 1: A preview of graphs generated by Cacti



Figure 2: Create Device page of Cacti

```
net-snmp-config --create-snmpv3-user -X \
<passphrase> -a <password> <username>
```

Now, in order to check whether your SNMP set-up is working or not, you can use a tool called `snmpwalk` as follows:

```
snmpwalk -v <version_number> -c \
<community> <hostname/ip_address>
```

If this fails, you need to verify whether the `snmpd` service is running and your firewall is not blocking port 161 on the desired host.

**Step 2—Configure PHP:** You will need to uncomment/add the following lines to your `php.ini` file, if your distribution hasn't done it automatically:

```
extension_dir = /etc/php.d
; Enable mysql extension module
extension=mysql.so
; Enable snmp extension module
extension=snmp.so
session.save_path=/tmp
file_uploads = On
```

**Step 3—Configure Apache:** Configure Apache Web

server to serve Cacti through your browser. Edit your `/etc/apache2/httpd.conf` file to add the following line:

```
Include conf.d/*.conf
```

Add the following lines to `/etc/httpd/conf.d/php.conf` file:

```
LoadModule php5_module modules/libphp5.so
AddHandler php5-script .php
AddType text/html .php
DirectoryIndex index.php
```

Restart the `apache` service to see the changes.

Note that the paths of the above Apache config files may vary from distro to distro. So, just in case you are unable to locate these files, consult your distribution documentation to find where the Apache configuration files are stored.

If your distribution installs Cacti to `/usr/share/cacti`, you can use `vhst` to point to Cacti directory. Please check the Apache documentation on `vhsts` for more information at [httpd.apache.org/docs/2.0/vhsts/](http://httpd.apache.org/docs/2.0/vhsts/) for version 2.0

**Step 4—Configure MySQL:** Now, check whether your MySQL service is running (if not, start it). Create a database and a MySQL user for Cacti as follows:

```
CREATE DATABASE <db_name>;
```

```
GRANT ALL ON <db_name>.* ON '<db_user>'@'<hostname>' IDENTIFIED
BY <password>;
FLUSH PRIVILEGES;
```

**Step 5—Configure and Install Cacti:** If you have downloaded a tarball of Cacti from the website, untar it as follows:

```
tar xzvf cacti-<version>.tar.gz
```

Edit the configuration files to provide database information. Cacti is installed in `/usr/share/cacti` for most RPM-based distributions:

```
$EDITOR <path_to_cacti>/includes/config.php
$database_type = "mysql";
$database_default = "<db_name>";
$database_hostname = "<hostname>";
$database_username = "<db_user>";
$database_password = "<password>";
```

Now set permission for the Cacti user to access the `rra/` and `log/` directories. This step is needed to enable proper logging and creation of graphs:

```
cd <path_to_cacti>
chown -R <cacti_user> rra/ log/
```



Edit the `/etc/crontab` file to run the poller to generate graphs:

```
*/5 * * * * <cacti_user> php <path_to_cacti>/poller.php > /dev/null 2>&1
```

Optionally, you can install *spine* to get a faster poller engine. Download it from [www.cacti.net/spine\\_download.php](http://www.cacti.net/spine_download.php) and check compilation instructions at [www.cacti.net/spine\\_install.php](http://www.cacti.net/spine_install.php)

Now, open your Web browser and point to the Cacti directory by using the following URL: `http://<address_of_server>/cacti`

Go through the easy two-step installation process and you will come across a login screen. Enter the username and password as admin and admin, respectively. It will prompt you to set a new password for admin to secure your Cacti install.

That's it! Your Cacti installation is ready to serve you.

## Let's configure, now

After you log in, the home page provides you with three options: *Create devices*, *Create graphs* and *View*. If you click on *View*, you will notice that there's already a local host device showing a few graphs—Memory Usage, Load Average, Logged In Users and Processes. At this point, you will not be able to see any graphs, as they have not yet been generated. If you take a look after a few minutes, you will notice the graphs, but they will have NaN for all the values. Again, look back in five to 10 minutes, and you will see that the graphs have been filled up with polled statistics.

Now, let us try adding new devices (hosts) and new graphs, and show them on a new graph tree.

The following are the steps to create a new device:

1. Go to *Console* tab on the Cacti Web page.
2. Click on *Create Device* (see Figure 2).
3. Click on *Add* at the top right side of the page.
4. Fill in the fields shown in Figure 3. I've explained the important fields below:
  - 'Description', as the name suggests, is the description of the device. For example, HTTP server.
  - 'Hostname' is the fully-qualified hostname or IP address. For example, foo.bar.com or 192.168.1.1
  - 'Host Template' is for selecting the template matching the host type. This is useful in getting templates while creating graphs.
  - 'SNMP version' is the version of snmp running on the device. Version 3 requires the user name, password and pass phrase created with *net-snmp-config* earlier in the article. Version 1 and 2 only require the 'community' string.
5. Click on the *Create* button at the bottom right corner of the page after you've filled in all the fields.
6. The device has been added now. Scroll to the bottom of the page to see the status of the device (see Figure 4).

Figure 3: The Add device form in Cacti

Figure 4: The newly added device shows up in the status as Success

Figure 5: Link to create a graph for newly created device

Now that you have created a device, you will see a link for 'Create Graphs for this Host' at the top of the page after creating the device (Figure 5). After clicking it, in the *Create* drop-down box under the 'Graph Templates' section (Figure 6), select the type of graph you want to create. Check the required fields in the 'Data Query' section, if any, returned by the SNMP lookup. Now, click on the *Create* button and your graph is ready.

If you want to add more graphs, go to the *Console* tab, click on *Create graphs*. Select the host you want to create a graph for, and follow the above steps to create a graph again.

I'm sure by now you've created a few graphs. At this point, you will notice that only 'localhost' is displayed; the other devices that you added are nowhere around. Since we would like to see them too, here's the way to create a new graph tree:

1. Go to 'Graph Trees' under the 'Management' section listed on the left side pane (Figure 7).
2. Click on *Add* at the top right side of the page.
3. Enter the name of the tree, select the type of sorting, and click on *Create* (Figure 8).

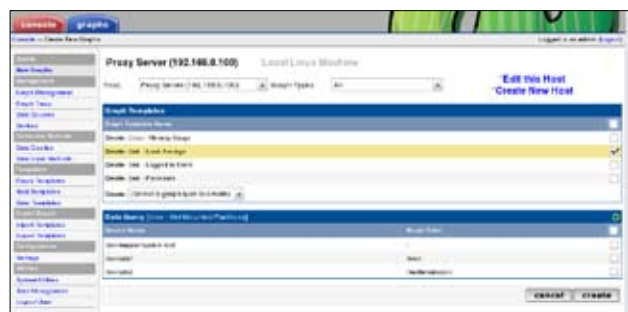


Figure 6: Setting graph template and data queries

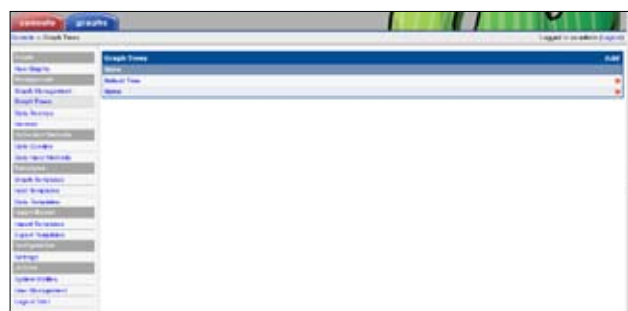


Figure 7: Add graph trees here

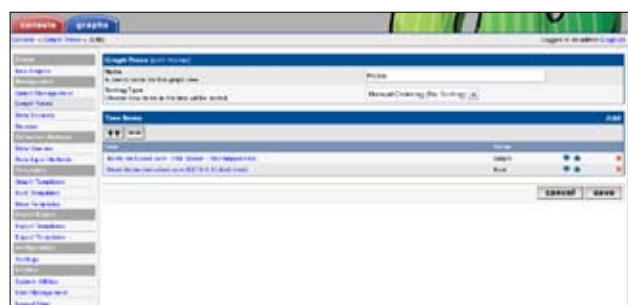


Figure 8: Selecting the type of sorting of the tree

4. Now, click on **Add** next to tree items to add items to the tree (Figure 9), and fill in/select the required information. The following are details of the parameters:

- *Parent Item*
  - 'root' is the main trunk of the tree and all your items will be placed below this.
  - '<header\_name>' is the branch of the tree under which you want to place your new item.
- *Tree Item Type*
  - 'Header,' as the name suggests, is the header under which the rest of the items will go. It is useful in case multiple locations are being monitored—for example, departments in the office.
  - 'Graph' is the graph to be displayed.
  - 'Host' is the host to be displayed on the graph. This will show all the graphs under the host.

- Click *Create* when you have finished.

If you need to edit an existing graph tree, you can do so in a similar fashion by selecting the 'Graph Trees' link under the 'Management' section on the left side pane of

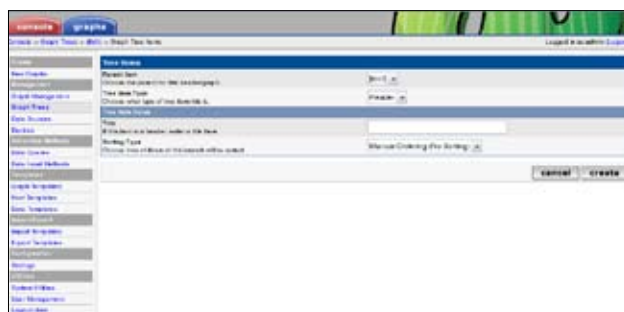


Figure 9: Adding items to the tree

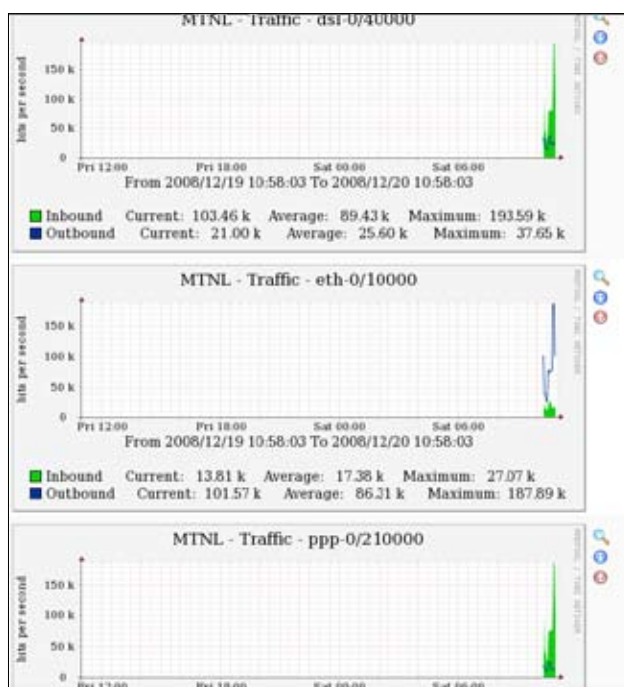



Figure 10: Cacti graph for MTNL broadband traffic

the Cacti page. Next, select the tree to edit. Then click on *Add* next to the tree items to add items to the tree.

Have a look at Figure 10 now—its Cacti graphs are monitoring my MTNL traffic.

Cacti can handle functions ranging from various complex networks to different kinds of services. In the end, you always get pretty graphs for more or less everything. And we all know how monitoring graphs makes our lives so much easier. **END** 

## References

- RRDTOol: [oss.oetiker.ch/rrdtool](http://oss.oetiker.ch/rrdtool)
- Cacti homepage: [www.cacti.net](http://www.cacti.net)
- Cacti Docs: [docs.cacti.net](http://docs.cacti.net)
- FAQ: [www.cacti.net/downloads/docs/html/faq.html](http://www.cacti.net/downloads/docs/html/faq.html)
- Forums: [forums.cacti.net](http://forums.cacti.net)
- Mailing List: [www.cacti.net/mailling\\_lists.php](http://www.cacti.net/mailling_lists.php)

By: Mehul Ved

The author is a FOSS enthusiast interested in technology. He is fond of the command line and networking.

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# Vulnerability Assessment

## Have You Done it Yet?

Regular vulnerability assessment of your systems/networks is a must. OpenVAS is one such tool that can assist you.

**Y**ou don't need to read a book to understand why vulnerabilities in systems can put them at potential risks. Vulnerabilities may exist in your network due to misconfigured or unpatched systems. This brings us to the subject of vulnerability assessment and management—a process of identifying the presence of vulnerabilities and reducing the security risk of your system to an acceptable level.

There are various assessment tools that assist IT security professionals in identifying vulnerabilities in servers and desktops. You can initiate a scan and identify potential network and system weaknesses using vulnerability scanners. These security scans can run either on remote or local systems against target systems.

Challenges in the current scenario are:

1. The non-availability of open source vulnerability assessment tools
2. Understanding the architecture of VAS (vulnerability assessment systems)
3. Implementing a VAS tool.

### VAS architecture

Typically, the design of a VAS should meet the following basic requirements:

1. Configured to reach all target systems
2. Authenticated access to the VAS server and sessions
3. A constant updating of the VAS plug-in database before initiating a scan
4. Defining a scan frequency and ear-marking

the target systems that fall within the scope of scanning

5. Ensuring secure availability of scan reports with time stamping.

OpenVAS—Open Vulnerability Assessment Scanner, a fork of the now closed-source Nessus security scanner—is an open source vulnerability assessment tool. It works on a client-server architecture, which has the following four components:

1. OpenVAS server
2. OpenVAS feed server
3. OpenVAS client
4. Target systems

The OpenVAS server requires to be configured in a manner to fetch updates or the latest plug-in feeds from the publicly-hosted OpenVAS Feed Repository server. The OpenVAS server will contact the repository server to identify available updates and download them.

The OpenVAS client is a GUI client used to manage, configure and report scan results. Access to the OpenVAS server is controlled by a secure password- or certificate-based authentication. Through the OpenVAS client software you can specify target systems, port range, NVT (network vulnerability test) and initiate the scan. The OpenVAS client will show you the real-time status of your scan and report the relevant results. You can manage various scans by grouping IP addresses based on category and saving them in separate sessions. Results under each session are stored in that particular session

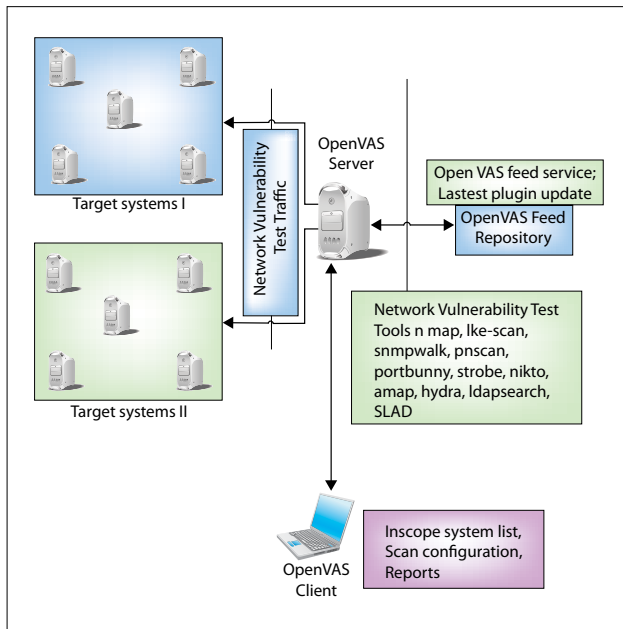


Figure 1: OpenVAS architecture

and kept separately.

After you initiate your scan, the OpenVAS server will have attack traffic between it and the target systems. OpenVAS will initiate port scans and network vulnerability tests on target systems to identify potential weaknesses in systems.

## Components

Let's look more closely into the four components of OpenVAS:

1. **OpenVAS Server:** This is the main component of OpenVAS, which is connected via a GUI-based client in order to scan target systems. Server and client communication only include configuration and scan initialisation traffic. Actual scan traffic (network vulnerability test traffic) flows between the server and target systems (as shown in Figure 1). The server has four components: *openvas-libraries*, *openvas-libnasl*, *openvas-server* and *openvas-plugins*.
2. **OpenVAS Client:** This is a GUI- or terminal client-based application that is used to establish and initiate network vulnerability tests against target systems. The client connects to the server by authenticating itself either using a password or a certificate. The client is a successor of NessusClient.
3. **OpenVAS NVT Feed:** NVT stands for network vulnerability tests. These are signature files that are available as plug-ins on the OpenVAS repository server. By default, the OpenVAS Server is configured to fetch plug-in updates from the repository server.
4. **OpenVAS LibNASL:** The NVTs are written in the Nessus Attack Scripting Language (NASL). This module contains the functionality needed by the OpenVAS Server to interface with NASL.

## Tools

OpenVAS Server is integrated with lots of powerful open source software, ranging from network to application security toolkits. Table 1 (on page 70) lists various tools that have been integrated with OpenVAS.

## Implementation

OpenVAS needs to be installed on a machine that will act as a network scanning server. You may install OpenVAS Client software on your desktop and connect to the server over the network. The server runs on port 1241. Network firewalls should be configured appropriately to allow scans and administrative traffic of OpenVAS to pass through it. It is also recommended to keep the scanning server in a different network zone than that of your production server.

For effective vulnerability management, you should know the scope, scan frequency, incident management and remediation. There should be a complete list of systems that are within the scope of scanning, along with the scan frequency. Although OpenVAS does not have a feature to automate vulnerability scans, you can still create sessions and save them. Each session can be opened simultaneously and run against available network vulnerability tests.

Incident management will include a formal process of reporting, and informing the security team about security vulnerabilities reported by OpenVAS. You can generate

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Kenneth Gonsalves

# Freedom and Security

Are openness and security mutually incompatible?

The OSM [openstreetmap.org] map of Mumbai is 'b0rked'. Due to some problem with the initial import, all the streets are slightly out of alignment. After a lot of experimentation by all concerned, it was found that this cannot be corrected programmatically, and can only be done manually. I organised a sprint in Mumbai to start off the work on this. Some work was done, but not followed up. The upshot is that Mumbai is the only city in India with an inaccurate OSM map. It is accurate in parts, but by and large, unreliable.

Recently, Wikipedia used the OSM map of Mumbai to illustrate the terrorists' points of attack. I pointed out to the Mumbai LUG that it is not a good thing to have an inaccurate map. Many people were of the view that open maps like this only help terrorists and should be banned! So the question is: are openness and security mutually incompatible? Often one sees the view expressed: if your source code is visible to crackers, how can you protect your software against them? The best security is secrecy—if they cannot see the code, it is all the more difficult to crack it.

Looking at the Mumbai attacks, the terrorists had all the information they needed—the security forces were the people who were hampered by lack of information. If they had had instant access to the floor plans of the places under attack—with digital maps and helmet mounted devices to show where they were—the loss of lives could have been much less and the operation more efficient.


The problem with keeping information secret is that when it is needed, the process of getting the information is time consuming. Terrorists attack at night when the guy with the password for the secret maps is asleep. Second, if the maps are secret, there is no way of finding out if they are accurate. This goes for proprietary code also—since no one can see the code, there is the possibility of a large number of undetected vulnerabilities and back-doors that crackers can exploit. Yes, open source code also has vulnerabilities, but since the code is open, these show up very soon and can be rectified.

Open source software is so successful because the developer employs the end user as a partner. The result is that hundreds of thousands of people are involved in developing, testing and patching open source software. And the same thing happens in open content sites like Wikipedia and OSM. Yes, terrorists will use the maps, but at the same time, when disaster strikes—be it a flood, a tsunami or an earthquake—accurate, and instantly accessible maps will save a huge number of lives. Apart from major disasters, in case of individual emergencies like heart attacks and accidents too, accurate maps enable efficient routing, which saves precious minutes of ambulance time.

Whether it is a server, an application or protection against terrorist acts, security is a process that involves both the developer/sys admin/the authorities on one hand, with the end users/citizens on the other hand. Where the code/maps are open, and both sides are partners in closing loopholes and developing the system, the system becomes more secure. On the other hand, if everything is kept secret and closed, the citizens are kept out of the loop. So in times of emergency, panic and confusion

reign and the magnitude of the disaster increases exponentially.

We should learn a lesson from the US government—they have a rule that anything developed with public money should be put in the public domain. They have given the world the GPS system, they have released the CIA maps for public use, and the US Army has released world-class 3D CAD software (BRL-CAD) and GIS software (GRASS). No doubt there is a knee-jerk reaction demanding that information helpful to terrorists be classified. But the people who are going to suffer if the information is classified are the public, not the terrorists.

Openness and security are two sides of the same coin—one cannot exist without the other. **END** 

Kenneth Gonsalves

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# INDUSTRY NEWS



## Cisco sued over GPL violations

The Free Software Foundation (FSF) has filed a copyright infringement lawsuit against Cisco. The FSF's complaint alleges that in the course of distributing various Linksys products, Cisco has violated the licences of many programs on which the FSF holds copyright, including GCC, binutils, and the GNU C Library. In doing so, Cisco has denied its users their right to share and modify the software.

The programs are either licensed under the GPL or LGPL. Both these licences encourage everyone, including companies like Cisco, to modify the software as they see fit and then share it with others, under certain conditions. One of those conditions says that anyone who redistributes the software must also provide their recipients with the source code to that program.

The FSF has documented many instances where Cisco has distributed licensed software but failed to provide its customers with the corresponding source code.

"We began working with Cisco in 2003 to help them establish a process for complying with our software licences, and the initial changes were very promising," explained Brett Smith, licensing compliance engineer at the FSF. "Unfortunately, they never put in the effort that was necessary to finish the process, and now five years later we have still not seen a plan for compliance. As a result, we believe that legal action is the best way to restore the rights we grant to all users of our software."

The complaint was filed on December 11, 2008 in the US District Court for the Southern District of New York by the Software Freedom Law Centre, which is providing representation to the FSF in this case. A copy of the complaint is available at [www.fsf.org/licensing/complaint-2008-12-11.pdf](http://www.fsf.org/licensing/complaint-2008-12-11.pdf)

## Nokia acquires Symbian

Nokia has completed the acquisition of Symbian Ltd. Symbian is the software company that develops and licenses the Symbian OS, an operating system targeted for mobile devices. User interfaces designed for the Symbian OS include S60 from Nokia, MOAP (S) for the 3G network and UIQ, designed by UIQ Technology, a joint venture between Motorola and Sony Ericsson. Nokia, now, owns more than 99.9 per cent of Symbian shares. It is planned that all Symbian employees will become Nokia employees on February 1, 2009.

In June 2008, Nokia announced a plan to acquire the 52 per cent of Symbian it doesn't already own and set up the Symbian Foundation, making the platform open source in the process. Nokia said it would buy out the remaining Symbian shares from Sony Ericsson, Panasonic, Siemens and Samsung for € 264 million.

Lee Williams, nominated executive director, Symbian Foundation, said, "When the Foundation begins operations, which is expected during the first half of 2009, it will have a uniquely strong ecosystem of developers, manufacturers and network operators, all committed to building an open platform to set free the future of mobiles."

As previously announced, the Symbian Foundation will work to make the platform available in open source by June 2010.

## Theodore Ts'o is the new CTO at the Linux Foundation

The Linux Foundation has appointed Linux kernel developer Theodore Ts'o as its chief technology officer. Ts'o will be replacing Markus Rex, who recently returned to Novell to work as the acting general manager and senior vice president of its OPS business unit.

In his new role, Ts'o will lead all technical initiatives for the Linux Foundation, including oversight of the Linux Standard Base (LSB) and other work groups such as Open Printing. He will also be the primary technical interface to LF members and the LF's technical advisory board, which represents the kernel community.

"Ted is an invaluable member of the Linux Foundation team, and we are happy he is available to assume the role of CTO where his contributions will be critical to the advancement of Linux," said Jim Zemlin, executive director, the Linux Foundation. "We are also very grateful to Markus Rex for his assignment at the Foundation and thank him and Novell for their commitments to Linux and the LSB."

Ts'o has been a Linux Foundation fellow since December 2007. Since 2001, Ts'o has worked as a senior technical staff member at IBM, where he most recently led a worldwide team to create an enterprise-level real-time Linux solution. He will return to IBM after this two-year fellowship at The Linux Foundation.

Ts'o is known as the first North American kernel developer. Other current and past LF fellows include Steve Hemminger, Andrew Morton, Linus Torvalds and Andrew Tridgell.



# INDUSTRY NEWS

## Seclore and CDAC to bring security to OSS platforms

IIT Bombay-promoted Seclore and the Centre for Development of Advanced Computing (CDAC) have partnered to bring security to the open source platform. The partnership will focus on bringing Seclore's content level encryption (CLE) security technologies like FileSecure and InfoSource to open source platforms. According to the partners, they have taken up the mandate to ensure that advanced Information Rights Management and secure outsourcing solutions become available ubiquitously.

Speaking on the occasion, Vishal Gupta, chief executive officer, Seclore, said, "CDAC is India's foremost computing research and training institute and we are extremely proud to partner with it in this endeavour. The availability of FileSecure and InfoSource on open source technologies will bring increased security to these environments."

## SUSE Linux Enterprise 9 and 10 boast of most certified software apps

Novell has announced that more than 2,500 software applications are now certified on the latest versions of SUSE Linux Enterprise, with an average of 140 new applications being added each month. Based on publicly available information, SUSE Linux Enterprise 9 and 10 have the most certified software applications when compared to the latest releases of all other commercial Linux distributions.

To complement this breadth of support, SUSE Linux Enterprise is also a preferred Linux platform for many of the most important enterprise software vendors and is the fastest growing Linux distribution, according to IDC.

## HP puts GNU/Linux on one of its desktop offerings

While the days of Windows Vista may not be numbered, it's certainly challenging times for Microsoft's operating system thanks to its OEM partners, many of who are now inching towards GNU/Linux systems. HP has joined the bandwagon of such 'friendly' OEM partners, by introducing GNU/Linux as an operating system choice for business desktop customers. The offerings are designed to help small businesses enhance their productivity and ease their management of technology.



To provide customers with more cost-effective and secure computing options, HP has introduced a new desktop offering with SUSE Linux Enterprise Desktop on the HP Compaq DC5850. This joint solution delivers a tightly integrated suite of essential applications, including an office suite, Web browser, multimedia tools, and e-mail, collaboration and instant messaging software to drive productivity for business customers.

For education customers, HP is working with Novell to develop and maintain a repository of more than 40 applications, including maths, art and word games, to improve student learning. In addition, applications for school administration and instruction will be available for teachers and administrators.

HP has also announced the expansion of its virtualised browsing solution across select business desktop products. The Mozilla Firefox for HP Virtual Solution was jointly developed by Symantec and Mozilla for HP customers. The solution uses the standard release of Mozilla Firefox with a Symantec Software Virtualisation Solution layer that allows customers to use the Internet productively while keeping business PCs stable and easier to support.

## Sony Ericsson now part of Open Handset Alliance

Sony Ericsson has extended its portfolio to include support for the Open Handset Alliance. Membership of the Open Handset Alliance will complement the company's existing Open OS strategy, which is based on the Symbian and Windows Mobile platforms. "Sony Ericsson is excited to announce its membership of the Open Handset Alliance and confirm its intention to develop a handset based on the Android platform," said Rikko Sakaguchi, CVP and head, creation and development, Sony Ericsson.

The Open Handset Alliance (OHA) is a business alliance of 48 firms including Google, HTC, Intel, Motorola, Qualcomm, Samsung, LG, T-Mobile, NVIDIA and Wind River Systems that came together to develop open standards for mobile devices. Besides Sony Ericsson, 13 new companies have joined the Open Handset Alliance. The new members are: AKM Semiconductor Inc, ARM, ASUSTek Computer Inc, Atheros Communications, Borqs, Ericsson, Garmin International Inc, Huawei Technologies, Omron Software Co Ltd, Softbank Mobile Corporation, Teleca AB, Toshiba Corporation and Vodafone.

New members will either deploy compatible Android devices, contribute significant code to the Android Open Source Project, or support the ecosystem through products and services that will accelerate the availability of Android-based devices.





# INDUSTRY NEWS



## Microsoft-free desktop solution, courtesy IBM

IBM has announced the availability of a Linux desktop solution designed to drive savings compared to Microsoft's desktop software. The combined solution includes virtual desktop, Ubuntu, and IBM Open Collaboration Client Solution software. This Microsoft-free solution runs open standards-based e-mail, word processing, spreadsheets, unified communication, social networking and other software to any laptop, browser or mobile device from a virtual desktop login on a Linux-based server configuration.



A virtual desktop, which looks like a traditional desktop, is not limited to a single physical computer, according to the company. Instead, many virtual Linux desktops are hosted on a server. The combined solution includes: virtual desktop provided by Virtual Bridges called Virtual Enterprise Remote Desktop Environment (VERDE); Ubuntu; and IBM Open Collaboration Client Solution software (OCCS) based on IBM Lotus Symphony, IBM Lotus Notes and Lotus applications. IBM Lotus Symphony is built on the Open Document Format (ODF).

This solution is now a key component of IBM's financial services front office transformation offering, as well as part of the IBM public sector industry solution framework.

Compared to Microsoft-based desktops, this virtual desktop solution will enable cost avoidance of \$500 to \$800 per user on software licences for Microsoft Office, Windows and all related products. It will also translate to cost avoidance of around \$258 per user since there is no need to upgrade hardware to support Windows Vista and Office 2007, a cost avoidance of \$40 to \$145 per user from reduced power to run the configuration, and \$20 to \$73 per user from reduced air conditioning requirements from lower powered desktop devices, annually. Other potential benefits are a 90 per cent savings of desktide PC support, 75 per cent on security/user administration, 50 per cent of help-desk services such as password resets, and 50 per cent for software installations, which are replaced by software publishing.

## Sun's new initiative for emerging markets

To expand its customer base across its emerging markets (EM), Sun Microsystems has rolled out a regional tele-coverage model that will help reach high-growth SMBs, start-ups and Web 2.0 companies in emerging economies. The tele-coverage model will go live across the EM region and will be implemented by local companies that Sun has partnered with in these markets. The EM region consists of 139 countries spanning Latin America, South and Eastern Europe, India and Greater China.

On this initiative, Peter Ryan, executive vice president, global sales and services, Sun Microsystems, said, "Today's roll out of the tele-coverage model is Sun's first major initiative in the EM region. This new business tool supports our sales efforts and increases the average number of leads generated, lead-to-order conversion and new customer acquisition. This model also demonstrates the investment we are making in these geographies through our local partners."

The tele-coverage model, first implemented in India, has been operationally very successful here for the last six years, the company claimed. It has been instrumental in contributing to a significant part of Sun's local revenue growth.

## Wind River to offer commercial Android solution

Wind River is going to offer a commercial software solution based on Android, the open source mobile software. The solution will comprise software systems integration services and a compatible commercially supported Android software platform for handset manufacturers and mobile operators planning to develop Android-based devices and services.

Wind River's commercial software platform for Android is expected to include the latest open source Android software and Wind River's commercial-grade Linux. This also includes Android-specific Linux patches, and pre-integrated third-party technologies to help commercialise Android. Additionally, the platform is expected to be optimised on leading mobile semiconductor hardware from which manufacturers can quickly build market-differentiated products. Wind River's commercially supported Android software platform is expected to be available in the first half of 2009.

## Huawei to launch Android phone in 2009

Huawei Technologies has announced its entry into the Open Handset Alliance and its plan to launch smartphones based on the Android



platform in 2009. Supporting the Android platform, members of the Alliance promote an integrated mobile software stack that incorporates the operating system, middleware, user-friendly interfaces and applications. Huawei has established strategic partnerships with most of the Alliance's members, including China Mobile, Telefónica and T-Mobile.





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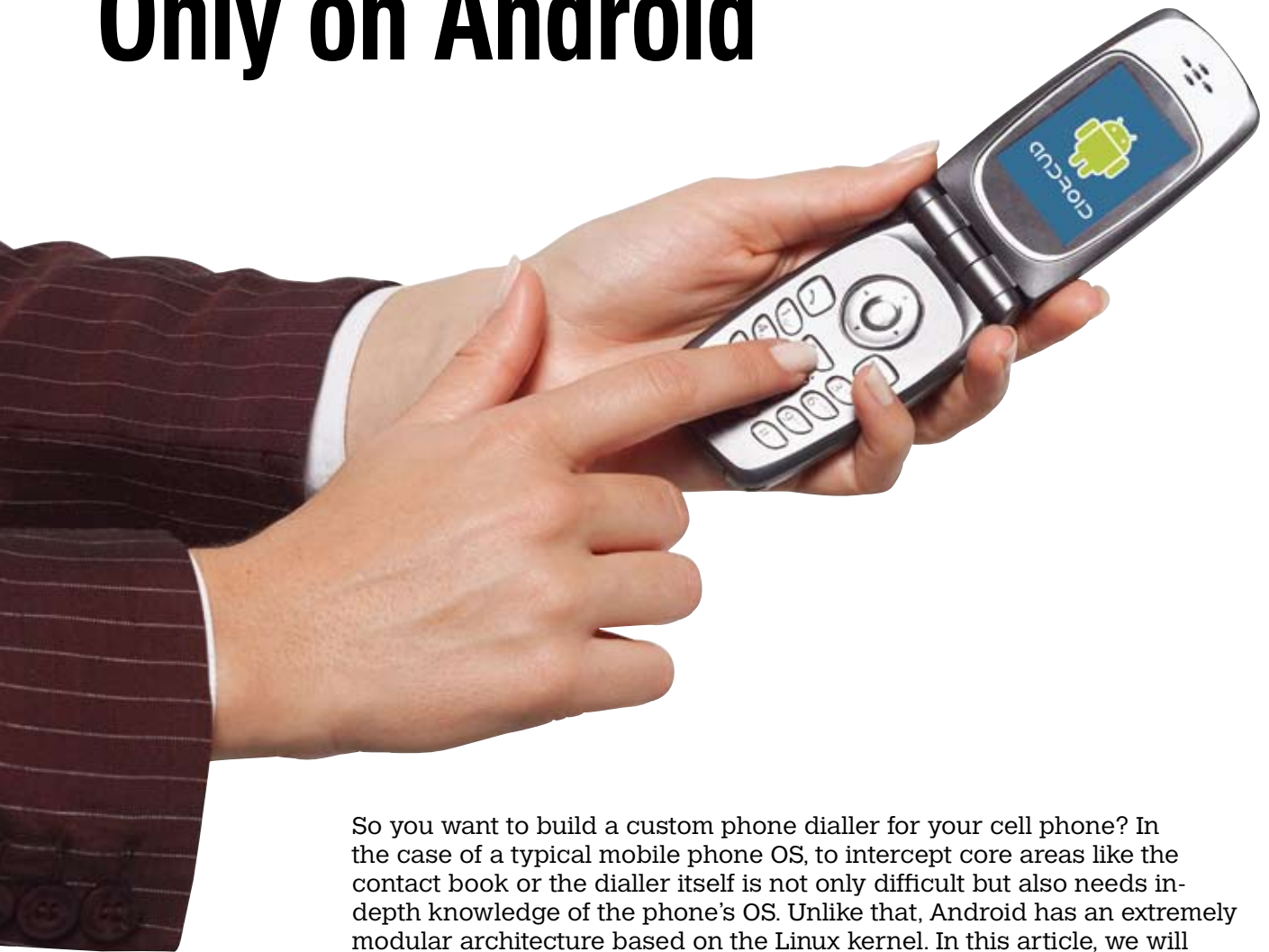


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# My Own Phone Dialler

## Only on Android



So you want to build a custom phone dialler for your cell phone? In the case of a typical mobile phone OS, to intercept core areas like the contact book or the dialler itself is not only difficult but also needs in-depth knowledge of the phone's OS. Unlike that, Android has an extremely modular architecture based on the Linux kernel. In this article, we will learn how to harness the power of one such API in Android.

Android is an open source stack of software that includes an operating system with a Linux kernel for handheld devices.

It includes device drivers and a Java-based user interaction layer with the kernel/OS. Android is built with an aim to provide a free robust OS to all mobile and handheld devices, and a modular

platform to build applications that can leverage the power of a Linux kernel in handheld devices.

The modularity in the entire stack of Android helps develop applications that can interact with the phone book, SMS driver, GPRS communication channel, etc, in a much easier fashion than possible with alternatives. Also, because

it is free, it can decrease the TCO (total cost of ownership) of the phone. Given that Android works from within an open community initially formed by OHA (Open Handset Alliance) and now by Google, the abundance of freely available software for handheld devices, or rather Android-based devices, should increase once it is launched in the market.

## Architecture overview

Android has a layered architecture with the total abstraction of the kernel/drivers from the application programs. The stack mainly consists of four layers. The bottom-most layer consists of the Linux kernel and device drivers. The kernel communicates with the libraries layer. The second layer is the libraries layer, which is made up of the various libraries of Android like standard graphics libraries (OpenGL), SSL, SQLite (a database library), etc.

Apart from the libraries, this layer also contains the most important part of the stack, commonly known as the Android Runtime or the DVM (Dalvik Virtual Machine). Just like the JVM, DVM abstracts applications programs from the kernel. This results in platform independency, so an application once written for Android can be run on any handheld device running Android, whatever hardware it may be running on.

The third layer is the application framework layer, which has pre-written modules for the phone, like an activity manager, window manager, telephony manager, notification manager, location manager, etc. If we draw an analogy to the Java world, Android runtime can be extended to the JVM, and application framework can be extended to the JRE library (Java Runtime Environment). The application framework is responsible for exposing the API for application development.

On top of all these three layers is the final layer—the applications themselves. For example, a phone dialler is an application that uses the telephony management API from the application framework layer. This, in turn, will use a core library of the stack and, in turn, the serial device driver from the Linux kernel to make a call using serial commands to communicate with the GSM-based SIM card.

An architecture diagram of Android is available on Google's site for Android at [code.google.com/android/what-is-android.html](http://code.google.com/android/what-is-android.html), which has been reproduced here in Figure 1 for easy reference.

## Pre-requisites

Instead of going into the depths of each library, we will focus on developing an application on the Android platform. We will focus on running the application on a simulator.

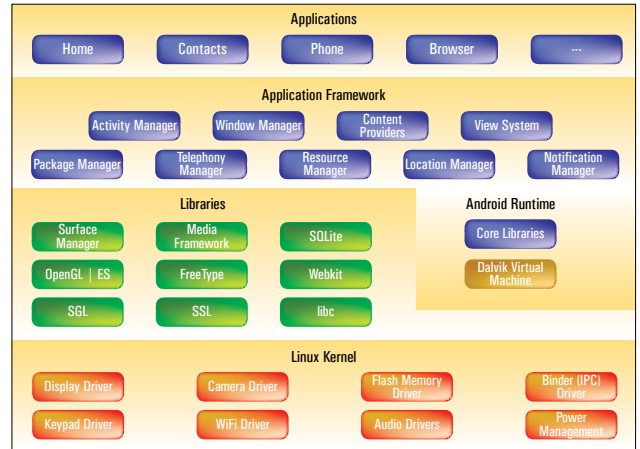


Figure 1: The Android architecture

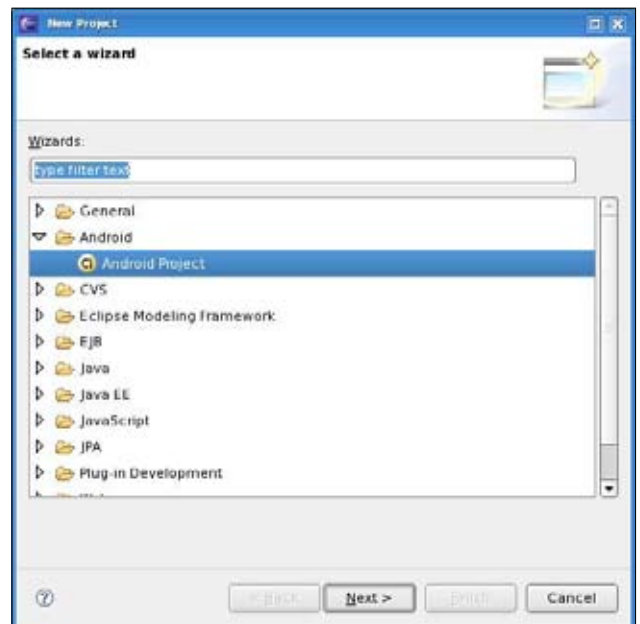


Figure 2: From the New Project wizard, select Android Project

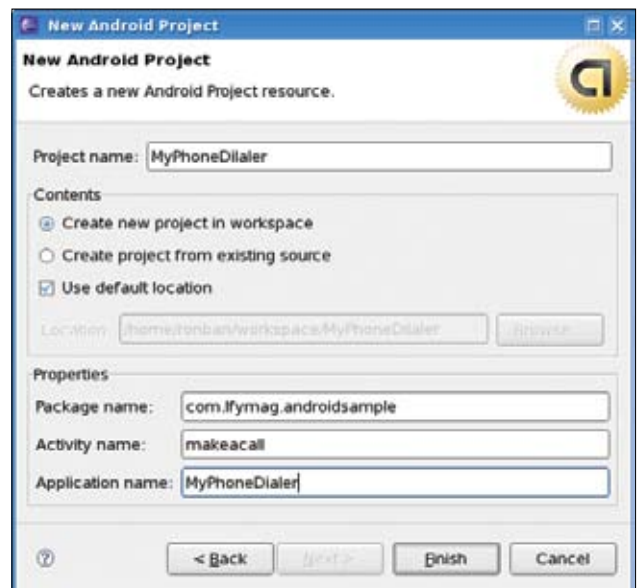


Figure 3: Define project name in the New Android Project wizard



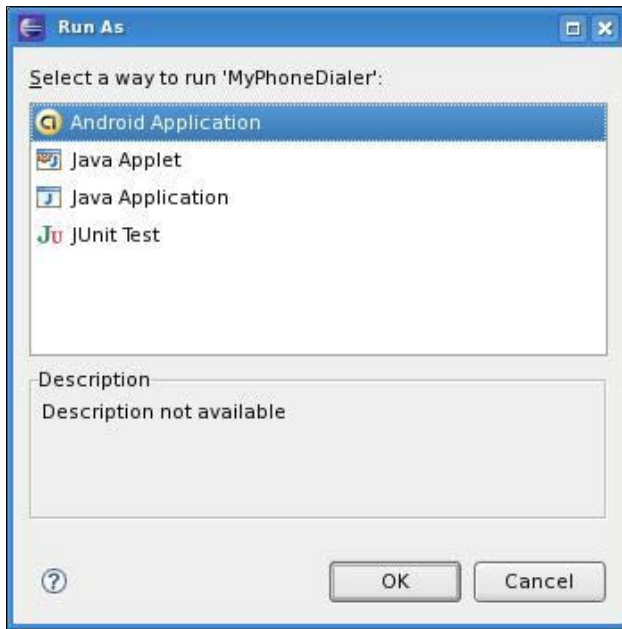


Figure 4: In Eclipse, right click the Android project and select 'Run as an Android Application'

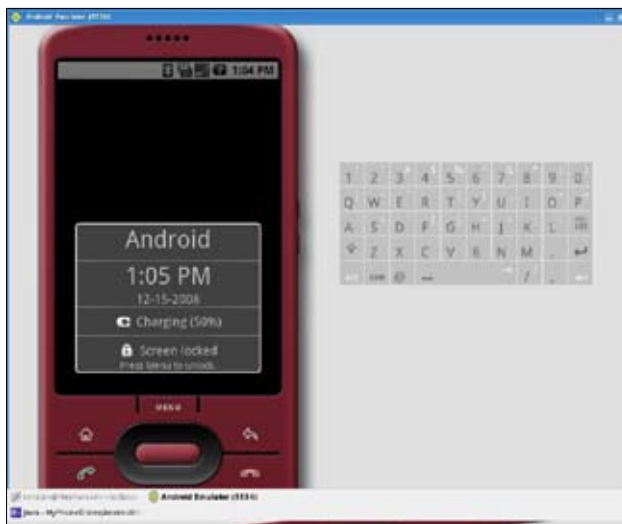


Figure 5: Emulator starts

We will need the following pre-installed on a PC for the exercise:

1. JDK 1.5
2. Eclipse 3.3/3.4 with JDT and WST plug-ins
3. The Android SDK
4. Android development tools (optional)

We are carrying out the exercise on a Ubuntu 8.10 using Sun Java 1.6 and Eclipse 3.4 (Ganymede). And we used `apt-ed sun-java6-bin` for a Java installation. You can alternatively download JDK 1.6 for Linux from <http://java.sun.com/javase/downloads>.

We downloaded Eclipse 3.4.1 (Ganymede) for Linux 32-bit from [www.eclipse.org/downloads](http://www.eclipse.org/downloads). We also downloaded Android SDK from [code.google.com/android/download.html](http://code.google.com/android/download.html). Installation



Figure 6: The project hierarchy

instructions can be found at [code.google.com/android/intro/installing.html](http://code.google.com/android/intro/installing.html).

Once Android SDK and Eclipse are installed (you can follow the document [help.ubuntu.com/community/EclipseIDE](http://help.ubuntu.com/community/EclipseIDE)) on Ubuntu, we started Eclipse and installed the ADT on the Android Development Toolkit. We installed it as an Eclipse plug-in from `Help-->Software Updates-->Available Software-->Add-->Site-->https://dl-ssl.google.com/android/eclipse/-->Install`.

Once done, you need to restart Eclipse.

## Simulator and the Android Eclipse plug-in

Once everything is ready, we can do some development on the Android platform. Before that we need to run the Android simulator. Figures 2, 3, 4 and 5 are some screenshots to help you get started with the Android simulator from within

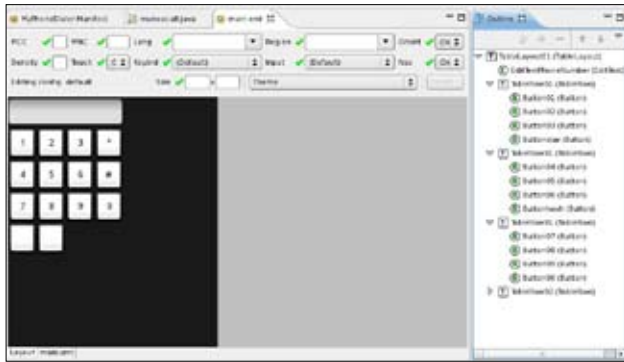


Figure 7: The layout manager

Eclipse.

Now that we know how to run a simulator, we will go through the basics of an Android Project in the Eclipse IDE. Figure 6 shows the project hierarchy.

It contains the *src* directory, the Android library, the resource bundle directory and the Android manifest.

Most of the work that concerns the UI of the application is contained in the resource bundle folder called *res*. It has three sub-directories: *drawable* contains all pictures/icons/photos; *layout* has the layout of the application screens; and *values* holds the language file called *strings.xml*, a colour definition file called *colors.xml*, and *styles.xml*, which contains all the styles of the UI components on the screen.

The *AndroidManifest.xml* is the manifest file or something equivalent to a deployment descriptor, which has information about the application -- both descriptive and security information.

The source folder has all the sources related to the activities, viz., events on what action will be taken when buttons are clicked, etc.

## Building the application

First, to build a dialler we need to create a dial pad and a place-holder for the numbers in it. Also, we have to place two buttons that will represent the *dial* and the *cancel* activities. We will group both these events under one activity called 'makeacall'.

Now let's build the UI with the layout manager. If you open the *main.xml* file within the *res/layout* directory in the project, it will automatically open the layout manager. There should be a visual representation of the UI as shown in Figure 7.

Just like AWT or Swing in Java, Android also has something called different layouts. Here, the most relevant layout for a dial pad is a *TableLayout*. As per the diagram, the place holder for the number is an *EditText* component and there are four rows represented by a layout called *TableRow*. Each row has four buttons represented by a component called

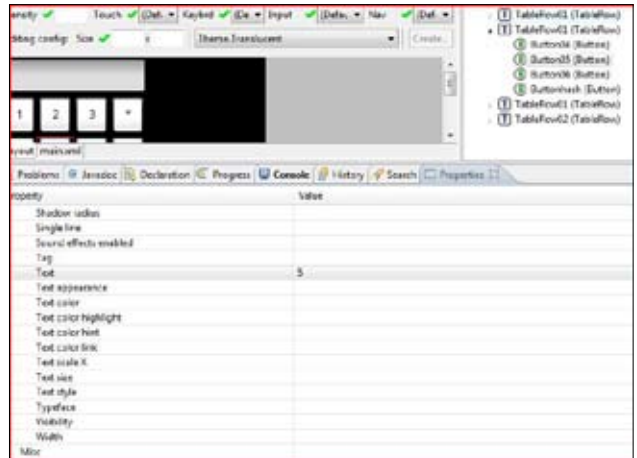


Figure 8: Setting values for the different objects



Figure 9: The dialler

**Button.** The last row contains two *ImageButtons*, which represent the *dial* and *cancel* buttons.

Once the layout is done, we will configure a few properties for these objects (Figure 8), beautify the contents of the buttons and make them look like a real dial pad.

Once all the properties are configured, the dialler will look something like the image in Figure 9.

The last step is to write the activities. Our activity 'makeacall' will look like the code presented in Listing 1.

Listing 1: Code for 'makeacall' activity

```
package com.ifymag.androidsample;
```

```
import android.app.Activity;
```

```
import android.content.ActivityNotFoundException;
```

```
import android.content.ContentUri;
```

```
import android.content.Intent;
```

```
import android.net.Uri;
```

```
import android.os.Bundle;
```

```
import android.widget.Button;
import android.widget.EditText;
import android.util.Log;
import android.view.View;
import android.view.View.OnClickListener;

public class makeacall extends Activity {

    EditText mEditor;

    /** Called when the activity is first created. */
    @Override
    public void onCreate(Bundle savedInstanceState) {
        super.onCreate(savedInstanceState);
        setContentView(R.layout.main);
        mEditor = (EditText) findViewById(R.id.EditTextPhoneNumber);

        /**
         * A call-back for when the user presses the number buttons.
         */
        OnClickListener mDialPadListener = new OnClickListener() {
            public void onClick(View v) {
                StringBuffer previousNumber = new StringBuffer(mEditor.
getText().toString());
                CharSequence phoneDigit = ((Button)v).getText();
                mEditor.setText(previousNumber.append(phoneDigit));
            }
        };

        /**
         * A call-back for when the user presses the call button.
         */

        OnClickListener mPhoneCallListener = new OnClickListener() {
            public void onClick(View v) {
                call(mEditor.getText().toString());
            }
        };

        // Hook up button presses to the appropriate event handler.
        ((Button) findViewById(R.id.Button00)).setOnClickListener(mDialPa
dListener);
        ((Button) findViewById(R.id.Button01)).setOnClickListener(mDialPa
dListener);
        ((Button) findViewById(R.id.Button02)).setOnClickListener(mDialPa
dListener);
        ((Button) findViewById(R.id.Button03)).setOnClickListener(mDialPa
dListener);
        ((Button) findViewById(R.id.Button04)).setOnClickListener(mDialPa
dListener);
        ((Button) findViewById(R.id.Button05)).setOnClickListener(mDialPa
dListener);
        ((Button) findViewById(R.id.Button06)).setOnClickListener(mDialPa
dListener);
        ((Button) findViewById(R.id.Button07)).setOnClickListener(mDialPa
dListener);
        ((Button) findViewById(R.id.Button08)).setOnClickListener(mDialPa
```

```
dListener);
        ((Button) findViewById(R.id.Button09)).setOnClickListener(mDialPa
dListener);
        ((Button) findViewById(R.id.Buttonstar)).setOnClickListener(mDialP
adListener);
        ((Button) findViewById(R.id.Buttonhash)).setOnClickListener(mDial
PadListener);

        ((Button) findViewById(R.id.ImageButtonDial)).setOnClickListener(m
PhoneCallListener);
    }

    private void call(String phoneNumber) {
        try {
            Intent callIntent = new Intent(Intent.ACTION_CALL);
            callIntent.setData(Uri.parse("tel:" + phoneNumber));
            startActivity(callIntent);
        } catch (ActivityNotFoundException activityException) {
            Log.e("dialing-example", "Call failed", activityException);
        }
    }
}
```

Run it and we have a custom dialler on a phone. The code is zipped and provided as an archive along with the *LFYCD*.

## Going forward with Android

Just like the dialler, Android supports multiple other APIs including some interesting GIS/GPS to work in cohesion with Google Maps. The modular architecture of Android differentiates the hardware functions and software applications in such a seamless manner that building applications on niche technology areas like GPS, VoIP, etc, is easily achievable by every developer with minimal efforts.

After doing a little bit of Android development, you might be interested in knowing about the award-winning application on Android called "CompareEverywhere" [*compare-everywhere.com*] written by Jeffrey Sharkey from Montana State University, who won \$250,000 for it. So start building your applications today and who knows, it might be *you* who bags the award the next time. :-)



### References

- [code.google.com/android](http://code.google.com/android)
- [www.openhandsetalliance.com](http://www.openhandsetalliance.com)

### By: Roney Banerjee

The author has been in the IT industry for the last nine years and is a passionate Linux follower. He is an entrepreneur, and the co-founder and CTO of Indience InfoSystems.



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# **EDUTECH EXPO**

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# Session Management Using PHP

## Part 2: Server-side Sessions

The second part of the article explains the formation of sessions on the server side without the need to store any information on the client machine. This strategy provides better security for the session information and permits sessions to form even if cookies are disabled on the client applications.

Managing a session from the server side provides a safe mechanism to maintain the session. The session created using this technique can be spread across several pages loaded through many browsers (Firefox, Konqueror, Opera, or even IE). It means that the session does not expire even if one browser crashes and the same URL is loaded through another browser. Security settings of the client machine do not affect server-side session management.

For all these goodies, we have to spend time on a few extra lines of code

and provide one extra database table. A table called *session\_log* is created in the *session* database, with columns for storing a session ID, user ID, IP address of the remote machine, status of the session (enumerated as VALID or EXPIRED, numeric values 1 or 2), start time and last-access time. Entries in the *session\_log* table are made by the login script and updated by the status script.

The script for the display of the user name and password fields for login is given below (the script is saved in a file named *dbloginform.html*):

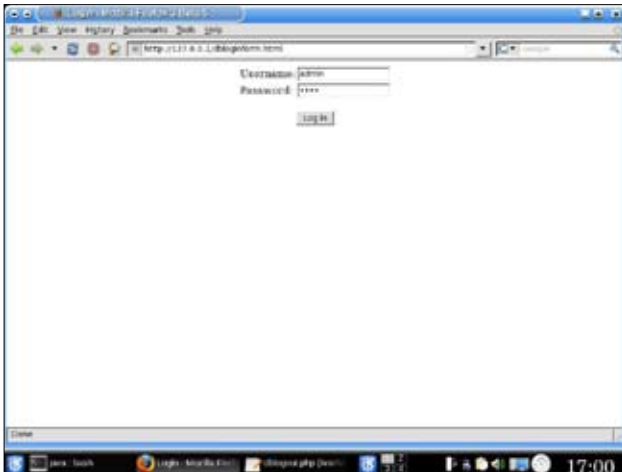


Figure 1: Login prompt shown by calling dbloginform.html

```
<html><head><title>Login</title></head>
<body>
<form method="post" action="dblogin.php">
<center>
<table border=0>
<tr>
<td><label for="username">Username:</label></td>
<td><input type="text" id="username" name="username" maxlength="50"
/></td>
</tr>
<tr>
<td><label for="passwd">Password:</label></td>
<td><input type="password" id="passwd" name="passwd" /></td>
</tr>
</table><br />
<input type="submit" value="Log in" />
</form>
</body></html>
```

The resulting login screen is shown in Figure 1.

## Logging in

The login process is handled by the script *dblogin.php*, which takes the user name and password and checks for the validity of the pair. After doing so, a session ID is generated, which needs to be a unique number. In the present case, the *microtime()* function with 'true' as an argument was called and the result was printed into a string called *\$t*. A *while* loop was run until the session ID got inserted into the database. The login screen is shown in Figure 2 and the login script is provided below:

```
<?php
/*dblogin.php*/
$user;
$session_id;
function dblogin($u, $p)
{
global $user, $session_id;
```



Figure 2: Login screen for server-side session management

```
$con = mysql_connect('localhost','user','pass') or die(mysql_error());
mysql_select_db('session', $con) or die(mysql_error());

$res=mysql_query("select id, decode(pass,'session') as pass from user where
name='", addslashes($u). "','", $con) or die(mysql_error());
if(mysql_num_rows($res) != 1) {
    printf("<center><h1>User %s not found</h1><br /><a href=\
'dbloginform.html'>Go to login page</a></center>", $username);
    return false;
}
if(mysql_result($res,0,"pass") != $p) {
    printf("<center><h1>Login attempt rejected for %s</h1><br /><a
href='\"dbloginform.html\">Go to login page</a></center>", $username);
    return false;
}

$uid = mysql_result($res,0,"id");
$t = sprintf("%.12f",microtime(true));
$done = false;
while(!$done) {
    $done = true;
    mysql_query("insert into session_log values ($t,$uid, '$_
SERVER[REMOTE_ADDR]',1, now(), now()),'$con) or $done=false;
    if(!$done)
        $t = sprintf("%.12f",microtime(true));
}

$user=$u;
$session_id=$t;
mysql_close($con);
return true;
}

if(dblogin($_POST['username'], $_POST['passwd']))
    printf("<center><b>Welcome %s! Your session id is %s</
b><br/><n\"",$user, $session_id);
    print("<a href='\"dbloginstatus.php\">Check session status</
a><br /><a href='\"dbprotectedimage.php\">View Image</a><br /><a
href='\"dblogout.php\">Logout</a></center>");
?>
```





Figure 3: Status check for a valid session

The login script obtains the IP address of the remote client using the global variable `$_SERVER[REMOTE_ADDR]`. The user ID is obtained from the user table. The starting and last access times are also inserted into the table. The script begins working from the *if* condition found at the foot, calls *dblogin()* function and waits for the boolean result to arrive from the function. The function returns true only if all the checking operations are successfully completed.

## Checking session status

Clicking the 'Check session status!' link takes us to the status checking script, named *dbloginstatus.php*. This script checks whether the IP address of the machine requesting the page holds a valid session. The session might expire either by calling *dblogout.php* (clicking the link or directly entering the URL) or by time out. The time limit is specified by the *\$time\_out* variable, which stores the maximum permissible time since the last access. In the present case, the time limit was set to 120 seconds, to quickly test the time-out message. But, in the case of real-world projects, it may vary from 1,200 seconds (20 minutes) to 2,400 seconds (40 minutes).

Status messages for valid sessions and timed-out sessions are shown in Figures 3 and 4. The status monitoring script, given below, should be included at the top of all the pages that require to be protected for the access of valid users:

```
<?php
/*dbloginstatus.php*/
$user;
$session_id;
$time_out=120;
function checkStatus() {
    global $time_out;
    $uid;
    global $user, $session_id;
    $valid=false;
    $remote_ip = $_SERVER['REMOTE_ADDR'];
```

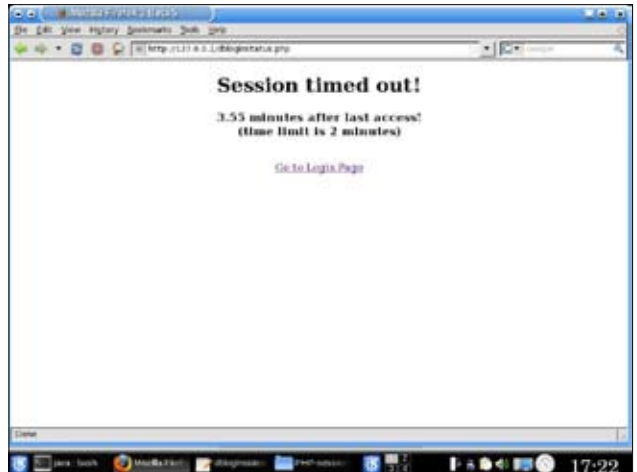


Figure 4: Status check for a timed-out session

```
$con = mysql_connect('localhost','user','pass') or die(mysql_
error());
mysql_select_db("session", $con) or die(mysql_error());
$res = mysql_query("select user_id, session_id, status,
time_to_sec(timediff(now(), last_access)) as duration from session_log
where remote_ip='$remote_ip' and session_id=(select max(session_id) from
session_log where remote_ip='$remote_ip');", $con) or die(mysql_error());
if(mysql_num_rows($res) == 0) {
    print("<center><h1>Invalid Session!</h1><br />");
    mysql_close($con);
    print("<a href='\"dbloginform.html\"'>Go to Login
Page</a></center>");
    exit(0);
}

$session_id = mysql_result($res,0,"session_id");
$uid = mysql_result($res, 0, "user_id");
$d = mysql_result($res,0,"duration");
$n=mysql_num_rows($res);
$st=mysql_result($res,0,"status");
if($st == "EXPIRED") {
    print("<center><h1>Invalid Session!</h1><br />");
    mysql_close($con);
    print("<a href='\"dbloginform.html\"'>Go to Login
Page</a></center>");
    exit(0);
}
else if($d > $time_out) {
    print("<center><h1>Session timed out!</h1><h3>\"
. ($d/60) . \" minutes after last access!<br />(time limit is \" . ($time_out/60) . \"
minutes)</h3><br />");
    $res = mysql_query("select @m:=max(session_id)
from session_log where remote_ip='$remote_ip'", $con);
    $res = mysql_query("update session_log set
status=2 where remote_ip= '$remote_ip' and session_id=@m;", $con) or
die(mysql_error());
    mysql_close($con);
    print("<a href='\"dbloginform.html\"'>Go to Login
Page</a></center>");
```



Figure 5: Protected content (dbprotectedimage.php) for a valid session

```

        exit(0);
    }

    mysql_query("update session_log set last_access=now() where
remote_ip='$remote_ip' and session_id=$session_id;", $con) or die(mysql_
error());

    $res=mysql_query("select name from user where
id=$uid;", $con);
    $user=mysql_result($res, 0, "name");
    mysql_close($con);
    return true;
}

if(checkStatus()) {
    printf("<center><b>Welcome %s! Your id is: %s</b><br
/>", $user, $session_id);
    printf("<a href='\"dblogout.php\"'>Logout %s</a></center>", $user);
}
?>

```

The script starts working from the *if* condition found at the bottom of the script. The status checking script verifies whether the session already expired or whether had timed out. An appropriate message is displayed for both the cases. If the session is valid, the script sets the last-access time on the *session\_log* table to the current time.

## Protecting content using a server-side session

Once the login, session status and logout scripts are created for server-side session management, protecting the pages is similar to cookie-based sessions (discussed in last month's issue). Calling *require\_once('dbloginstatus.php')* at the top of the protected pages ensures that only authorised persons view the content:

```

<?php
/*dbprotectedimage.php*/

```



Figure 6: Protected content (dbprotectedimage.php) for an invalid session

```

require_once('dbloginstatus.php');
print("<div align='\"center\"'><img src='\"summer.jpg\"' width=75%></div>");
?>

```

The protected page for a valid session is shown in Figure 5 and that of an invalid session is shown in Figure 6.

## Logging out from a server-side session

The session can be explicitly terminated by calling the *dblogout.php* URL, which sets the status to EXPIRED (or the numeric value 2). After the *dblogout.php* script is called, entering any protected page is not permitted. Figures 7 and 8 show the logout screen and the message displayed when calling *dbloginstatus.php* after completing the session. The *dblogout.php* script is listed below:

```

<?php
function logoutUser() {
    $uid;
    $time_out=120;
    $user;
    $valid=false;
    $remote_ip = $_SERVER['REMOTE_ADDR'];
    $con = mysql_connect('localhost','user','pass') or die(mysql_
error());

    mysql_select_db("session", $con) or die(mysql_error());
    $res = mysql_query("select user_id, session_id, status, (now()-
last_access)/60 as duration from session_log where remote_ip='$remote_ip'
and session_id=(select max(session_id) from session_log where remote_
ip='$remote_ip');", $con) or die(mysql_error());
    $session_id = mysql_result($res,0,"session_id");
    if(mysql_num_rows($res) == 0 || mysql_result($res,0,"status")
== "EXPIRED") {
        print("<center><h1>Invalid Session!</h1><br />");
        mysql_close($con);
        print("<a href='\"dbloginform.html\"'>Go to Login
Page</a></center>");
        exit(0);
    }
}

```

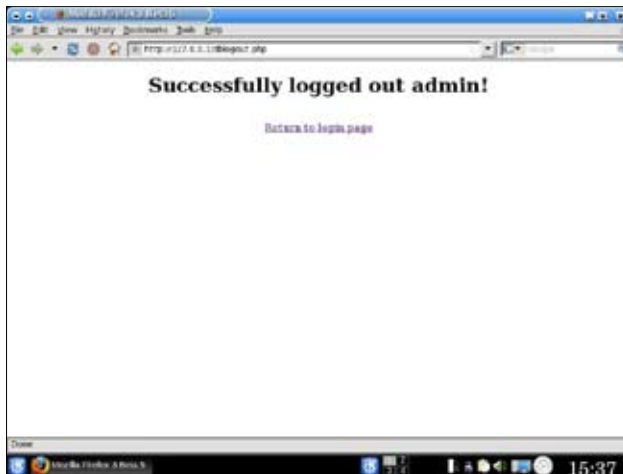


Figure 7: Logout message

```

else if(mysql_result($res,0,"duration") > $time_out) {
    print("<center><h1>Session timed out!</h1></center><br />");

    $res = mysql_query("select @m:=max(session_id)
from session_log where remote_ip='$remote_ip'", $con);

    $res = mysql_query("update session_log set
status=2 where remote_ip='$remote_ip' and session_id=@m," $con) or
die(mysql_error());

    mysql_close($con);
    print("<a href='\"dbloginform.html\"'>Go to Login
Page</a>");

    exit(0);
}

$suid = mysql_result($res,0,"user_id");
$res = mysql_query("select name from user where id=$suid,"
$con) or die(mysql_error());
$user = mysql_result($res,0,"name");
$res = mysql_query("update session_log set status=2, last_
access=now() where remote_ip='$remote_ip' and session_id=$session_id,"
$con) or die(mysql_error());
print("<center><h1>Successfully logged out $user!</h1><br
/>");
print("<a href='\"dbloginform.html\"'>Return to login page</a></center>");

$res = mysql_query("update session_log set status=2 where
(now()-last_access)/60 >= $time_out," $con) or die(mysql_error());
mysql_close($con);
}
logoutUser();
?>

```

The logout script sets the status of the session to *Expired* and the last-accessed time to the current time. If the session was already closed or timed out, the logout script will display the appropriate message and terminate. Figure 9 shows the entries in the *session\_log* table. This table would serve both as a record of the



Figure 8: Status message after logging out

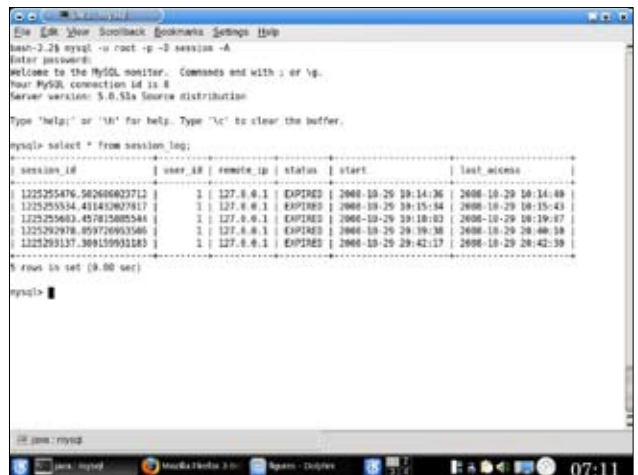



Figure 9: Session log maintained by the server

login/last-accessed times for users as well as a safe mechanism to hold current session details.

## Pros and cons of server-side sessions

Forming sessions from the server side provides the safest strategy for the formation of sessions. The formation of sessions is fail-safe, since it is completely independent of cookies. Normally, server machines are better protected from intrusions. Hence, the chance of unauthorised people getting hold of session details is very limited. However, it takes a bit more coding effort on the part of the programmer.

After getting through the client- and server-side session management strategies, I'm sure you now will be able to easily protect Web content from the eyes of unauthorised users in your projects. Although server-side sessions are a bit tedious and time consuming, the results are more rewarding than the cookie-based implementation. **END** 

By: V. Nagaradjane

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# The Crux of Linux Notifier Chains



You can communicate between dynamic modules with notifier chains.

Linux is monolithic like any other kernel. Its subsystems or modules help to keep the kernel light by being flexible enough to load and unload at runtime. In most cases, the kernel modules are interconnected to one another. An event captured by a certain module might be of interest to another module. For instance, when a USB device is plugged to your kernel, the USB core driver has to communicate to the bus driver sitting at the top. This will allow the bus driver to take care of the rest. Another classic example would be of interfaces. Many kernel modules would be looking for a network interface state change. The lower level module that detects the network interface

state change, would communicate this information to the other modules.

Typically, communication systems implement request-reply messaging, or polling. In such models, a program that receives a request will have to send the data available since the last transaction. Such methods sometimes require high bandwidth or they waste polling cycles.

Linux uses a notifier chain, a simple list of functions that is executed when an event occurs. These notifier chains work in a publish-subscribe model. This model is more effective when compared to polling or the request-reply model. In a publish-subscribe model, the 'client' (subscriber) that requires notification of a certain event, 'registers' itself with the 'server' (publisher). The server will



inform the client whenever an event of interest occurs. Such a model reduces the bandwidth requirement or the polling cycle requirement, as the client no longer requests for new data regularly.

## Notifier chains

Linux uses notifier chains to inform asynchronous events or status, through the function calls registered. The data structure is defined in *include/linux/notifier.h*:

```
struct notifier_block {
    int (*notifier_call)(struct notifier_block *,
unsigned long, void *);
    struct notifier_block *next;
    int priority;
};
```

The notifier data structure is a simple linked list of function pointers. The function pointers are registered with 'functions' that are to be called when an event occurs. Each module needs to maintain a notifier list. The functions are registered to this notification list.

The notification module (publisher) maintains a list head that is used to manage and traverse the notifier block list. The function that subscribes to a module is added to the head of the module's list by using the *xxxxxx\_notifier\_chain\_register* API and deletion from the list is done using *xxxxxx\_notifier\_chain\_unregister*.

When an event occurs which is of interest to a particular list, then the *xxxxxx\_notifier\_call\_chain* API is used to traverse the list and service the subscribers. The 'xxxxxx\_' in the above APIs represents the type of notifier chains.

Let us now look at the different types of notifier chains in the following section.

## Types of notifier chains

Notifier chains are broadly classified based on the context in which they are executed and the lock/protect mechanism of the calling chain. Based on the need of the module, the notifiers can be executed in the process context or interrupt/atomic context. Thus, notifier chains are classified into four types:

- **Atomic notifier chains:** As the name indicates, this notifier chain is executed in interrupt or atomic context. Normally, events that are time critical, use this notifier. This also means it is a non-blockable call. Linux modules use atomic notifier chains to inform watchdog timers or message handlers. For example, *register\_keyboard\_notifier* uses *atomic\_notifier\_chain\_register* to get called back on keyboard events. This notifier is usually called from the interrupt context.
- **Blocking notifier chains:** A blocking notifier chain runs in the process context. The calls in the notification list could be blocked as it runs in the

process context. Notifications that are not highly time critical could use blocking notifier chains. Linux modules use blocking notifier chains to inform the modules on a change in QOS value or the addition of a new device. For example, *usb\_register\_notify* uses *blocking\_notifier\_chain\_register* to inform either USB devices or buses being added or removed.

- **Raw notifier chains:** A raw notifier chain does not manage the locking and protection of the callers. Also, there are no restrictions on callbacks, registration, or de-registration. It provides flexibility to the user to have individual lock and protection mechanisms. Linux uses the raw notifier chain in low-level events. For example, *register\_cpu\_notifier* uses *raw\_notifier\_chain\_register* to pass on CPU going up/down information.
- **SRCU notifier chains:** Sleepable Read Copy Update (SRCU) notifier chains are similar to the blocking notifier chain and run in the process context. It differs in the way it handles locking and protection. The SRCU methodology brings in less overhead when we notify the registered callers. On the flip side, it consumes more resource while unregistering. So it is advisable to choose this methodology where we use the notifier call often and where there's very little requirement for removing from the chain. For example, Linux module uses *srcu\_notifier\_chain\_register* in CPU frequency handling.

## Using notifier chains

Let us consider two modules: a publisher and a subscriber. The publisher module has to maintain and export a 'notification head'. Generally, this is exported through an interface function that helps the subscriber to register itself with the publisher. The subscriber has to provide a callback function through *notifier\_block*. Let us now look at how a publisher and a subscriber work using blocking notifier chains.

Assume a scenario in which an action needs to be taken by a module when a USB device is plugged into the kernel. Any USB activity is first detected by the USB core of the Linux kernel. The USB core has to 'publish' a notification list head to inform new USB devices of activity in the kernel. Thus the USB core becomes the publisher.

The USB core publishes its notification list through the following interface function and the notifier list data structure (snippet of *drivers/usb/core/notify.c* file):

```
18 static BLOCKING_NOTIFIER_HEAD(usb_notifier_list);
19
20 /**
21  * usb_register_notify - register a notifier callback whenever a
    usb change happens
22  * @nb: pointer to the notifier block for the callback events.
23  *
```

24 \* These changes are either USB devices or busses being added or removed.

```
25 */
26 void usb_register_notify (struct notifier_block *nb)
27 {
28     blocking_notifier_chain_register (&usb_notifier_list, nb);
29 }
30 EXPORT_SYMBOL_GPL(usb_register_notify);
```

The first step of the publisher is to provide a notifier list. The *usb\_notifier\_list* is declared as the notifier list head for the USB notification. An interface function that exports the USB notification list is also provided by the USB core. It is a better programming practice to provide an interface function than exporting a global variable.

Now, we can see how to write an example USB hook module that 'subscribes' to the USB core. The first step is to declare a handler function and initialise it to a *notifier\_block* type variable. In the following example (a sample *usbhook.c* file), *usb\_notify* is the handler function and it is initialised to a *notifier\_block* type variable *usb\_nb*.

```
/*
 * usbhook.c - Hook to the usb core
 */
#include <linux/module.h>
#include <linux/kernel.h>
#include <linux/usb.h>
#include <linux/notifier.h>

static int usb_notify(struct notifier_block *self, unsigned long action, void
*dev)
{
    printk(KERN_INFO "USB device added \n");
    switch (action) {
    case USB_DEVICE_ADD:
        printk(KERN_INFO "USB device added \n");
        break;
    case USB_DEVICE_REMOVE:
        printk(KERN_INFO "USB device removed \n");
        break;
    case USB_BUS_ADD:
        printk(KERN_INFO "USB Bus added \n");
        break;
    case USB_BUS_REMOVE:
        printk(KERN_INFO "USB Bus removed \n");
    }
    return NOTIFY_OK;
}

static struct notifier_block usb_nb = {
    .notifier_call =    usb_notify,
};

int init_module(void)
{
    printk(KERN_INFO "Init USB hook.\n");
```

```
/*
 * Hook to the USB core to get notification on any addition or removal of
USB devices
 */
    usb_register_notify(&usb_nb);

    return 0;
}
```

```
void cleanup_module(void)
{
    /*
     * Remove the hook
     */
    usb_unregister_notify(&usb_nb);

    printk(KERN_INFO "Remove USB hook\n");
}
```

```
MODULE_LICENSE("GPL");
```


The above sample code registers the *notifier\_block* *usb\_nb* using the interface function of the USB core. The interface function adds the *usbhook* function to the *usb\_notifier\_list* of the USB core. Now we are set to receive the notification from the USB core.

When a USB device is attached to the kernel, the USB core detects it and uses the *blocking\_notifier\_call\_chain* API to call the registered subscribers:

```
60 void usb_notify_add_bus(struct usb_bus *ubus)
61 {
62     blocking_notifier_call_chain(&usb_notifier_list,
USB_BUS_ADD, ubus);
63 }
```

This *blocking\_notifier\_call\_chain* will call the *usb\_notify* function of the USB hook registered in *usb\_notifier\_list*.

The above sample briefs you on the infrastructure of Linux blocking notifier chains. The same methodology can be used for other types of notifier chains.

Linux kernel modules are loosely coupled and get loaded and unloaded runtime with ease. An effective methodology is required to communicate between these modules. Linux notifier chains do this effectively. They are mainly brought in for network devices and can be effectively used by other technologies as well. As developers, we have to look for such utility functions that are available in the kernel and use them effectively in our designs instead of reinventing the wheel. 

By: Rajaram Regupathy.

The author welcomes your comments and feedback at [rera\\_raja@yahoo.com](mailto:rera_raja@yahoo.com)





S.G. Ganesh

# Some Puzzling Things About C Language!

Have you wondered why some of the features of C language are unintuitive? As we'll see in this column, there are historical reasons for many of C's features.

**1** Can you guess why there is no distinct format specifier for 'double' in the *printf/scanf* format string, although it is one of the four basic data types? (Remember we use *%lf* for printing the double value in *printf/scanf*; *%d* is for integers).

**2** Why is some of the precedence of operators in C wrong? For example, equality operators (*==*, *!=* etc) have higher precedence than logical operators (*&&*, *||*).

**3** In the original C library, *<math.h>* has all operations done in double precision, i.e., long float or double (and not single precision, i.e., float). Why?

**4** Why is the output file of the C compiler called *a.out*?

## Answers:

**1** In older versions of C, there was no 'double'—it was just 'long float' type—and that is the reason why it has the format specifier *%lf* (*%d* was already in use to indicate signed decimal values). Later, double type was added to indicate that the floating point type might be of 'double precision' (IEEE format, 64-bit value). So a format specifier for long float and double was kept the same.

**2** The confusion in the precedence of the logical and equality operators is the source of numerous bugs in C. For example, in *(a && b == c && d)*, *==* has higher precedence than *&&*. So it is interpreted as, *((a && (b == c)) && d)*, which is not intuitive.

There is a historical background for this wrong operator precedence. Here is the explanation given by Dennis Ritchie [1]: "Early C had no separate operators for *&* and *&&* or *|* and *||*. Instead it used the notion (inherited from B and BCPL) of 'truth-value context': where a Boolean value was expected, after 'if' and 'while' and so forth; the *&* and *|* operators were interpreted as *&&* and *||* are now; in ordinary expressions, the bit-wise interpretations were used. It worked out pretty well, but was hard to explain. (There was the notion of 'top-level operators' in a truth-value context.)


"The precedence of *&* and *|* were as they are now. Primarily at the urging of Alan Snyder, the *&&* and *||* operators were added. This successfully separated the concepts of bit-wise operations and short-circuit Boolean

evaluation. However, I had cold feet about the precedence problems. For example, there were lots of programs with things like: *if (a==b & c==d) ...*

"In retrospect it would have been better to go ahead and change the precedence of *&* to higher than *==*, but it seemed safer just to split *&* and *&&* without moving *&* past an existing operator."

**3** Since C was originally designed for writing UNIX (system programming), the nature of its application reduced the necessity for floating point operations. Moreover, in the hardware of the original and initial implementations of C (PDP-11) floating point arithmetic was done in double precision (long float or double type) only. Writing library functions seemed to be easy if only one type was handled. For these reasons, the library functions involving mathematics (*<math.h>*) were done for double types, and all the floating point calculations were promoted and were done in double precision only. For the same reason, when we use a floating point literal, such as 10.0, it is treated as double precision and not single precision.

**4** The *a.out* stands for 'assembler.output' file [2]. The original UNIX was written using an assembler for the PDP-7 machine. The output of the assembler was a fixed file name, which was *a.out* to indicate that it was the output file from the assembler. No assembly needs to be done in modern compilers; instead, linking and loading of object files is done. However, this tradition continues and the output of *cc* is by default *a.out*!

With this month, JoP is successfully entering its third year. Thanks for all your continuous feedback and support! Keep filling my mailbox as usual and I'll be more than happy to help you. Wishing you a happy new year!! 

## References:

- Dennis M. Ritchie, "Operator precedence", [net.lang.c](http://net.lang.c), 1982
- [cm.bell-labs.com/who/dmr/chist.html](http://cm.bell-labs.com/who/dmr/chist.html)

## S.G. Ganesh

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# What's in the Glass(Fish)?

Part 1

Well, it's an open source JAVA EE application server.

An application server is a software stack that provides the business logic of a large-scale distributed application. These business logic and business processes are used by other applications running on other computers or that may be running on the same computer. Application servers are used in scenarios where very complex transaction-based applications are continuously running. For the success of any business application, the optimal performance of these servers is very critical. Today, almost all organisations have their own application servers that provide the business processing logic to their applications.

If you look at how Wikipedia defines an application server: "An application server in

an n-tier architecture, is a server that hosts an API to expose business logic and business processes for use by third-party applications. The term can refer to:

1. The services that are made available by the server
2. The computer hardware on which the services are deployed
3. The software framework used to host the services such as the JBoss application server or Oracle application server."

The general architecture of an application server is shown in Figure 1.

The most desirable features of an application server are:

1. Data integrity
2. Load balancing
3. Centralised configuration

4. Security
5. Code integrity
6. High performance
7. Robustness
8. Scalability

A list of well-known open source application servers are:

1. GlassFish (available under Common Development and Distribution License and the GPL)
2. JBoss (GPL)
3. JonAs (GPL)

A notable exception in the above list is Apache Tomcat. It is a topic of continuous discussion among Java developers on whether this is an application server or a Web server. The classification actually depends upon how it is used. Refer [www.javaworld.com/javaworld/jw-01-2008/jw-01-tomcat6.html](http://www.javaworld.com/javaworld/jw-01-2008/jw-01-tomcat6.html) for an interesting discussion.

In this article I am going to focus on GlassFish, which is a community-driven project started by Sun Microsystems in June 2005. I will present this article in two parts, the first of which will explain the basics about application servers and the architecture of GlassFish. In the second part, I will cover getting started with GlassFish on Linux.

## The foundation of the GlassFish community

GlassFish [[glassfish.dev.java.net](http://glassfish.dev.java.net)] is a community driven project to develop an open source productive Java EE 5 application server.

The base code of the project is donated by two industry giants:

1. Sun Microsystems—Sun Java System Application Server PE 9
2. Oracle—Top Link Persistence

## The architecture of GlassFish

The GlassFish community describes the design goal of GlassFish as:

1. To make an open, modular, extensible platform
2. A fast, easy, reliable application server
3. An enterprise-ready application server with massive scalability and sophisticated administration
4. Product updates and add-ons through the industry-strength Update Centre 2.0
5. Support for OSGi
6. Support for dynamic languages such as Ruby and Groovy
7. Support for Java EE 6

Let us go on to explore the overall design architecture.

## A modular subsystem

In enterprise development, where large scale distributed applications are continuously running, there is a strong need for isolation between various parts of an application. This is required because if any part of a large scale distributed application crashes, the whole system should not crash. Therefore, any application server ideally should

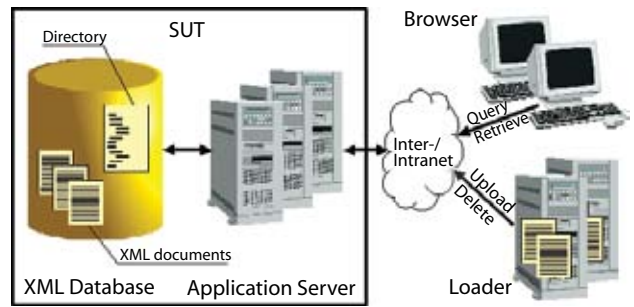


Figure 1: General architecture of an application server

be an assembly of modular sub-components.

The modular subsystem for GlassFish is based upon the Hundred KiloByte Kernel [[hk2.dev.java.net](http://hk2.dev.java.net)]. Generally known as HK2, it is a sub-project under the GlassFish Community. If we look closely at HK2, it is based on two technologies:

1. Modules Subsystem, and
2. Component Model

Modules Subsystem is responsible for instantiating various classes to provide application functionality and the Component Model is built upon the Modules Subsystem.

Component Model works very closely with Modules Subsystem and it configures the various objects created by the Modules Subsystem -- for example, bringing in other objects that are required by the newly created object, providing the newly-created objects to other existing objects, etc.

## Modules management

The GlassFish wiki defines the module management system as 'a distribution artifact'. A distribution is a collection of various modules and an artifact is a file that contains the distribution. GlassFish v3 will be available in various distributions. Just as today we have various distributions of GNU/Linux, each with its own set of features, similarly, various distributions of the GlassFish application server will have various modules and distinct features. Module management depends upon Maven [<http://maven.apache.org>]—a Java project management tool.

To add your module in a distribution, you have to follow these three steps:

1. Compile your module from its source code.
2. Create a file that contains the module.
3. Add the module's identification in the distribution list.

## Runtime

The GlassFish Application server is designed as a set of modules. It has no main class for its start up. Instead, it has a bootstrap module that is first loaded by the Class Loader. The bootstrap module loads other modules that are required. Also, care has been taken so that the bootstrap module does not load all the modules at the start time. But suppose the modules have been programmed such



that when they are loaded they refer to each other, then all the modules will be loaded at the start time, which will kill the basic aim of a modular designed server. To solve this problem, GlassFish uses a technique by which programmers are prevented from directly programming with modules. GlassFish uses a concept of service. These services are classes that implement an interface. And programmers are encouraged to program on these well-defined services instead of programming with modules.

## Persistence

Persistence is one of the most critical service given by an application server to the applications running on it. GlassFish has a lot of design challenges for its persistence service, mainly due to the old issues involved in the persistence mechanism. Java EE programmers have always seen various implementations of *javax.persistence.api*, which have issues with the old JDBC classes and their usage.

According to the GlassFish wiki, the following patterns were identified while designing persistence in GlassFish:

1. Applications can do a *Class.forName()* call to load a JDBC driver and make direct calls through the JDBC APIs to the underlying database. Applications do not need to identify a special interest in such drivers. There is also no indication they will use such low level access APIs.
2. Applications can decide to use the default JPA provider, letting GlassFish choose which one to use.
3. In Java SE mode, applications can use the *PersistenceProvider.createEntityManagerFactory()* call to get a specific persistence provider (name extracted from the *persistence.xml*).
4. In Java EE mode, GlassFish is responsible for loading the *persistence.xml* file, and looking up the expected persistence provider according to its settings (potentially defaulting the provider name).
5. In Java EE mode, GlassFish is responsible for identifying the connection pool to be used with the entity manager. This resource adapter is retrieved at deployment time from the JNDI name space and wired up with the persistence provider to create the entity manager.

## Container pluggability

Containers are the heart of an application server because they are the entities that run an application. For example, the EJB container in an application server is responsible for running Java EJB applications. This EJB container provides various additional features for Bean developers like security, scalability, client interaction and a messaging service. Thus, an application programmer is only concerned with implementing the business logic; all the other stuff is handled by the container. Containers are always created as pluggable units, such that they can be installed or removed from the application server.

According to the GlassFish wiki: "Containers have

the ability to install themselves in an existing GlassFish installation with the following services implementations:


1. **Sniffer:** Invoked during a deployment operation (or server restart). Sniffers will have the ability to recognise part (or whole) application bundles. Once a sniffer has positively identified parts of the application, its set-up method will be called to set up the container for use during that server instance lifetime.
2. **ContainerProvider:** This is called each time a container is started or stopped. A container is started once the first application that's using it is deployed. It will remain in operation until it is stopped when the last application using it has been stopped.
3. **Deployer:** This is called to deploy/undeploy applications to a container.
4. **AdminCommand:** Containers can come with a special set of CLI commands that should only be available once the container has been successfully installed in a GlassFish v3 installation. These commands should be used to configure the container's features."

## Winding up

The promise of the GlassFish community is to make a production-quality application server and add new features to it faster than even before. The following are the key features of the GlassFish Application server:

1. Production quality
2. Robust
3. Scalable
4. Secure
5. Has load balancing
6. Delivers more work with less code
7. Issue tracking
8. Service-oriented architecture.
9. Tools integration
10. Ease of container pluggability

And one of the most important features is that, being an open source project, we have access to the source code and can understand the bits and bytes of an enterprise-class application server.

In my next article I will explain how to get started with GlassFish. Additionally, I will also develop a simple Java enterprise application using GlassFish.  **END**

### References

- Wikipedia: [en.wikipedia.org/wiki/Application\\_server](http://en.wikipedia.org/wiki/Application_server)
- GlassFish home page: [glassfish.dev.java.net](http://glassfish.dev.java.net)
- GlassFish wiki: [wiki.glassfish.java.net](http://wiki.glassfish.java.net)
- The v3 Engineers' Guide: [wiki.glassfish.java.net/Wiki.jsp?page=V3EngineersGuide](http://wiki.glassfish.java.net/Wiki.jsp?page=V3EngineersGuide)

### By: Rajeev Kumar

The author is a Software Engineer working at Aricent Technologies. He loves working with GNU/LINUX and FOSS in general, as well as Java Enterprise Edition. You can send your comments or questions to [rajeevcoder@yahoo.com](mailto:rajeevcoder@yahoo.com)

# LINUX JOBS

## Post: Sr. Staff- Software Engineer

Company: Broadcom India Pvt. Ltd.  
Profile: Should have strong C and assembler coding background (C++ an asset). Experience with Linux or VxWorks, BSCS, BSEE or equivalent is required.  
Exp.: 8-13  
Location: Hyderabad  
Email: asidhar@broadcom.com

## Post: Head- Networking & Infrastructure

Company: Global Talent Track Pvt. Ltd.  
Profile: Candidate should have networking/infrastructure management experience, developing IM training material experience etc. Should have good troubleshooting skills on Linux, proficiency in system security etc.  
Exp.: 4-8  
Location: Pune  
Email: amrita@gttconnect.com

## Post: Testing Lead

Company: Agilis Information Technologies Intl. Pvt. Ltd.  
Profile: Incumbent should possess experience in testing of products or modules in test lead role, experience with querying the oracle database etc.  
Exp.: 4-7  
Location: Delhi  
Email: careers@agilisinternational.com

## Post: Technical Architect

Company: California Software Company Ltd.  
Profile: Should have excellent oracle PL/SQL skills with 8+ yrs of experience.  
Exp.: 8-12  
Location: Chennai  
Email: sivakumargg@calsoftgroup.com

## Post: Sr. Systems Administrator- Linux

Company: VMware India  
Profile: Responsible for managing production revenue applications, including those utilized by global partner sales, global service and support etc.  
Exp.: 5-10, Location: Bangalore  
Email: tamravy@vmware.com

## Post: Solution Architect

Company: Virtual Illusions  
Profile: Candidate should have sound knowledge of Java/J2EE design patterns, Java, File IO, JDBC, JSP, Servlets, Struts etc.  
Exp.: 8-13,  
Location: Delhi/NCR  
Email: careers@virtualillusion.net

## Post: GSOA Support Engineer

Company: Bhima Soft Pvt. Ltd.  
Profile: Responsible for ensuring smooth operations of all GSOA servers, servers are backed up and carryout scheduled restoration activities etc.  
Exp.: 5-8  
Location: Bangalore  
Email: abhilash.p@bhimasoft.com

## Post: Oracle DBA

Company: Ormitech Infosolutions Ltd.  
Profile: Should have good exposure to manual recovery & backup techniques, RMAN backup, up gradations etc.  
Exp.: 5-10  
Location: Mumbai  
Email: alan@ormitechindia.com

## Post: Chief Consultant- Embedded Electronics

Company: Stesalit Infotech Ltd.  
Profile: Candidate should have experience of handling product development team in heavy industry electronics, power electronics and VLSI. Equal exposure to s/w and firmware is must.  
Exp.: 7-10  
Location: Hyderabad  
Email: stesalit.grouphr@gmail.com

## Post: Open Source Solutions Architect- Tech Lead

Company: IT Shore  
Profile: Incumbent should have experience of software development, working with a variety of open source technologies etc.  
Exp.: 5-10  
Location: Hyderabad  
Email: rama@itshore.com

## Post: Web Solution Architect- PHP

Company: Senate Technologies (I) Pvt. Ltd.  
Profile: Should have experience in applying design patterns, architecting of solutions/applications, requirements management and change management. Must have experience in either Java or PHP, MySQL, Linux etc.  
Exp.: 7-12, Location: Pune  
Email: bhavindhi.sharma@senate-tech.com

## Post: Informatica 8x Professional

Company: Teradata Corporation  
Profile: Bachelors Degree (or higher) preferably in Computer Science, Information Systems, Mathematics or other related fields with knowledge and experience in the same domain.  
Exp.: 5-9  
Location: Mumbai  
Email: leena.pote@teradata.com

## Post: IT Consultant

Company: Logica Pvt. Ltd.  
Profile: Applicant should have technical DBA experience with Oracle 9i, technical DBA experience with Oracle 10g etc.  
Exp.: 4-6, Location: Chennai  
Email: prakash.aryal@logica.com

## Post: Front-End Web Developer

Company: Pontiflex  
Profile: Candidate should have excellent communication skills with 6+ yrs of experience.  
Exp.: 6-11, Location: Bangalore  
Email: careers@pontiflex.com

## Post: Oracle Apps DBA

Company: Bahwan Cyber Tek  
Profile: Should have exposure to OS as well as instance maintenance with 4+ yrs of experience.  
Exp.: 4-9, Location: Chennai  
Email: careers@bahwancybertek.com

## Post: Team Lead- Open Source (PHP)

Company: Agreya  
Profile: Incumbent should possess good knowledge of strong Core PHP 4/5, Ajax, Javascript, JQuery, Apache etc. with experience in complete software product lifecycle for product delivery.  
Exp.: 5-8, Location: Noida  
Email: poonam.sharma@agreya.com

## Post: C++ Software Engineer

Company: Basco Systems Pvt. Ltd.  
Profile: Applicant should have excellent knowledge of C++/Linux with experience in designing and development.  
Exp.: 4-6  
Location: Bangalore  
Email: careers@bascosys.com

## Post: Solaris & Linux Admin

Company: Tech People Consulting, Inc.  
Profile: Candidate should have working experience in both Solaris and Linux.  
Exp.: 4-6  
Location: Bangalore  
Email: usjobs@tpc-jobs.com

## Post: Desktop Engineer

Company: Interocan Shipping Co.  
Profile: Candidate should be Graduate/B.E in Computer Science, M.C.S.E/MCP certification with experience in installation & troubleshooting. Should have knowledge of WIN, LINUX, Hubs, Switches & Servers.  
Exp.: 5-8, Location: Delhi  
Email: jobs@interocangroup.com

## Post: Network- Service Desk & Site Support Specialist

Company: Market-1  
Profile: BE/ MCA/ ME/ M.Tech/ PhD with 4+ yrs of experience in the same.  
Exp.: 4-9, Location: Noida  
Email: nihongomathi@vsnl.net

## Post: Module Leader

Company: Birlasoft Ltd.  
Profile: Experience on credit cards domain would be an advantage.  
Exp.: 4-6, Location: Hyderabad  
Email: Ramarao.kandhi@birlasoft.com

## Post: Lead- MQ Series

Company: Proteans Software Solutions  
Profile: Should have experience in leading a team of developers on EAI development, IBM technologies like MQ series, websphere message broker etc. Exposure to variety of platforms like Solaris, Linux etc. is must.  
Exp.: 4-8  
Location: Bangalore  
Email: preethi.shashi@proteans.com

## Post: HP Unix, Linux & EMC Storage

Company: Goldstone Technologies Ltd.  
Profile: Incumbent should have experience in HP/UX, Linux (Preferably Redhat) and EMC.  
Exp.: 4-8, Location: Bangalore  
Email: jobs@goldstonetech.com

## Post: Java J2EE- Synechron Technologies

Company: Synechron Technologies  
Profile: Should have good hands on knowledge of JAAS, JBOSS and JSP.  
Exp.: 4-8, Location: Pune  
Email: jobs@synechron.com



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Sandya Mannarswamy

Welcome to another installment of CodeSport, which focuses on number theoretic algorithms. In particular, we will discuss the well-known 3-SUM problem, where given an array  $A$  of  $N$  numbers, we need to determine whether there exists a triple  $a, b$  and  $c$  that belongs to  $A$ , such that  $a+b+c = 0$ .

*T*hanks to all the readers who sent in their comments about the problems we discussed in the previous issue. Last month's takeaway question was the birthday problem. As you enter a room with  $N$  people, what is the probability that there is someone in the room whose birthday is on the same day as yours? You can assume that there are no leap years and all years have only 365 days. Also assume that it's equally likely that the birthday is on any day of the year. None of the solutions I received from readers this month had the correct solution. Therefore, we will keep this problem open this month too. Here are some directions to help the reader arrive at the solution.

Let us number the  $N$  people in the room as 1,2,3... up to  $N$ . We will use the loop index  $i$  to iterate over all people in the room and hence  $i$  can take values from 1,2,3... up to  $N$ . Let 'bi' be the day of the year in which the birthday of the person 'i' falls. 'bi' can take values from 1,2,3,... up to 365. If we assume that a person's birthday is equally likely to be any day of the year, the probability that a person's birthday falls on day 'D' is given by  $1/365$ . In mathematical terms, we can say that probability of 'bi' being equal to 'D' is  $1/365$ , for any 'i' from 1 to  $N$  and for any day from 1 to 365.

We can also assume that the birthdays of two people are independent events, in the sense that selecting 'D' as the first person's birthday does not affect the outcome in the selection of the birthday of the second person. Since the events are independent, the probability that two

people 'i' and 'j' have the same birthday can be calculated by computing these two independent events. Since these are independent, the probability that the birthday of 'i' is on day 'D' and the birthday of 'j' also is on day 'D' is nothing but multiplication of these two individual probabilities. This can be written as: Probability of (bi = D) and (bj = D) =  $1/365 * 1/365$ .

Hence the probability that the birthdays of 'i' and 'j' both falling on any day can be obtained by summing this probability over all possible values for the days. Hence the probability of (bi == bj) =  $\sum (1/365) * (1/365)$  over all days from 1 to 365.

Summing up  $((1/365) * (1/365))$  over all days from 1 to 365, we find that the probability of (bi == bj) is nothing but  $1/365$ . Let *Psame\_birthday* be equal to the probability that two out of the  $N$  people have a matching birthday. We can use the probability we calculated for (bi == bj) to show that  $\sqrt{N}$  people need to be present in the room in order for *Psame\_birthday* to be greater than 0.5. I leave it to the reader as an exercise. The hint to the solution is to consider the complementary event E1 of no two people in the room having the same birthday and then finding the probability of  $(1 - P(E1))$  which gives the probability that at least two people in the room have the same birthday.

## 3-SUM problem—a naive algorithm

Let us get started with this month's well-known number theoretic problem known as the 3-SUM problem. Given a set of



$N$  integers, you are asked to find out whether there are three numbers  $a$ ,  $b$  and  $c$  in the set of  $N$  numbers whose sum is equal to zero. The simplest algorithm can consider each triple of the numbers at a time, and check whether any triple satisfies the criteria of  $a+b+c=0$ . The following is the pseudo-code for this:

```
for i = 1 to N-2
  for j = i+1 to N-1
    for k = j+1 to N
      if (A[i] + A[j] + A[k] == 0)
        Return the triple (A[i], A[j], A[k]);
if no such triple found,
  return false;
```

What is the time complexity of the above algorithm? We can see that since there are three *for* loops running over  $N$ , hence the complexity is  $O(N^3)$ . Can we do better than this? Can we come up with a  $O(n^2)$  algorithm for this problem?

## $O(N^2)$ solution to the 3-SUM problem

We saw that in the above approach, we picked up triples blindly and hence ended up with  $O(N^3)$  complexity. How can we pick up triples more cleverly? Let us first sort the set of input numbers. Now we compare  $A[1]$ ,  $A[2]$  and  $A[N]$ . If the sum is zero, return the triple. If the sum is greater than zero, we compare  $A[1]$ ,  $A[2]$  and  $A[N-1]$ . And if the sum is less than zero, we compare  $A[1]$ ,  $A[3]$  and  $A[N]$ . Basically, since the numbers are sorted in increasing order, if the sum is above zero, we need to reduce the sum by using a smaller operand. If the sum is negative, we need to increase the value of the operand to make the sum zero. Given below is the pseudo code for this problem:

```
bool is_3_sum(array A[], N)
{
  for i = 1 to N-2
  {
    j = i + 1; k = N
    while (k > j)
    {
      if (A[i] + A[j] + A[k] == 0)
        Return true;
      else if (A[i] + A[j] + A[k] > 0)
        k = k - 1;
      else
        j = j + 1 //case when the sum is less than zero
    }
  }
  return false;
}
```

What is the complexity of the above algorithm? In the inner loop, during each iteration, we eliminate one element of the array from consideration; hence,

the inner loop runs for a maximum of  $N$  iterations and the outer loop runs for a maximum of  $(N-2)$  iterations. Hence, the overall complexity of the algorithm is  $O(N^2)$ . Now the interesting question is to determine whether we can come up with a sub-quadratic algorithm for this problem?

## Theoretical significance of the 3-SUM problem


Interestingly, all the research so far has not been able to come up with a sub-quadratic algorithm. The best measure of the complexity obtained so far has only been  $O(N^2)$ . Hence, it is widely believed that there is no sub-quadratic algorithm for this problem. However, this lower bound has not been theoretically established for all general models of computation, so the problem of finding a sub-quadratic solution to the 3-SUM problem still remains an open question in the field of algorithms.

The 3-SUM problem is interesting not just because we have not been able to find a sub-quadratic algorithm, but because many of the computation geometry problems can be reduced to an instance of the 3-SUM problem. There are problems like 3-point collinearity, where, given a set of  $N$  points, we need to decide whether any of the three points are collinear. A similar problem is in finding the minimum area triangle formed by three points from a given set of  $N$  points.

It can be shown that both these problems can be reduced to a 3-SUM problem in sub-quadratic time. Hence, if a sub-quadratic solution is found for the 3-SUM problem, both 3-point collinearity and the minimum area triangle also can be solved in sub-quadratic time. However, till date, no sub-quadratic solution has been determined for any of these problems.

## This month's takeaway problem

For this month's takeaway problem, let us consider a variant of the 3-SUM problem. You are given three sets of numbers  $A$ ,  $B$  and  $C$ , each containing  $N$  numbers. Can you come up with an algorithm to determine whether there is a triple— $a \in A$ ,  $b \in B$  and  $c \in C$ —such that  $a + b = c$ . It is quite easy to come up with a  $O(N^2 \log N)$  algorithm. But you need to come up with a  $O(N^2)$  algorithm for this. Here's a hint: use a variant of the 3-SUM algorithm to solve this problem.

If you have any favourite programming puzzles that you would like to discuss on this forum, please send them to me. Feel free to send your solutions and feedback at [sandyasm\\_AT\\_yahoo\\_DOT\\_com](mailto:sandyasm_AT_yahoo_DOT_com). Till we meet again next month, happy programming! 

**Sandya Mannarswamy**

The author is a specialist in compiler optimisation and works at Hewlett-Packard India. She has a number of publications and patents to her credit, and her areas of interest include virtualisation technologies and software development tools.

# A Voyage to the Kernel



## Part 8

### Segment: 2.2, Day 7

We are about to enter the core part of this segment—algorithms. An algorithm could be termed a sequence of computational steps that can transform an input into the output. Here, it should be emphasised that any such sequence cannot be called an algorithm since a wrong methodology will give an incorrect output.

Almost all the code used in this segment will be in a *pseudo-code* format that is akin to C code. Sometimes the algorithms are given in C itself. We have to stick to this format, as our primary intention is to meddle with the kernel.

Those who wish to have an overview of the importance of bringing in innovative algorithms and building simulations (based on them) can look up the GNU Hurd project.

As I promised earlier, this voyage will not neglect the novices. So, let's start with a few simple things. Let's suppose we have a set of values ranging from  $x_a, x_b, x_c, \dots, x_n$ . If you are asked to arrange them in ascending order, you need to write an algorithm so as to get the output as  $x_a, x_b, x_c, \dots$ , which satisfies the condition  $x_a \leq x_b \leq x_c, \dots$

This is a simple case of sorting, which is a common algorithm that we employ in our programs.

We just looked at an instance of the sorting problem. This may become more complex depending on the number of items to be

sorted, the extent to which the items are to be sorted, the current state (sorting) of the elements, possible restrictions on the items, and even on the kind of storage device used.

Hence, while dealing with algorithms, we need to consider the data structures employed with which we can manipulate the way to store and organise data in order to facilitate access and modifications as per our requirement.

Finding the shortest route is a kind of sorting algorithm. Consider a trucking company with a central warehouse. Each day, it loads up a truck at the central warehouse and then sends it around to several locations to deliver the products. At the end of each day, the truck should return to the central warehouse so that it is ready to be loaded for the next day. To find out the lowest operating cost, the company needs an algorithm that will indicate a specific order of delivery stops such that the truck travels the lowest overall distance.

If you have enough data in your hands, you can write down an algorithm. Now, let's look at how to write such an algorithm. For the sake of simplicity, let's replace our problem with a simple one.

Consider five cards of clubs—2, 4, 5, 7 and 10—which are placed randomly (just like we had random stops). If you were to play the game, you would have arranged the cards as shown in Figure 1.

But what if a computer had to play your role? How would it arrange the cards? The answer is quite simple: by employing the sorting algorithm. The following code elucidates the algorithm:

```
INSERTION-SORT(X)
for j ← 2 to length[X]
  do key-select ← X[j]
  ▷ Insert X[j] into series X[1... [j-1]]

  i ← j - 1
  while i > 0 and X[i] > key-select
    do X[i + 1] ← X[i]
    i ← i - 1

  X[i + 1] ← key-select
```

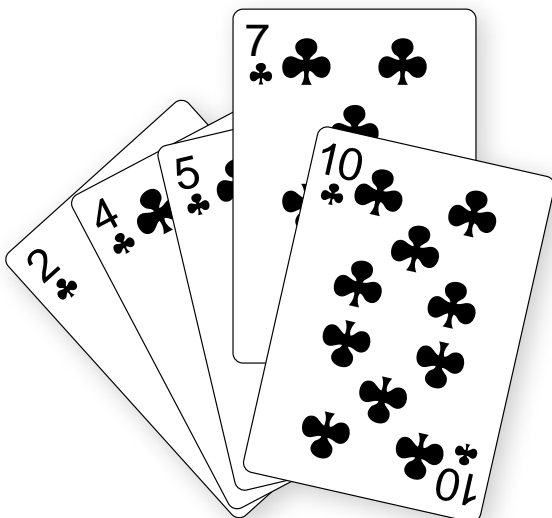


Figure 1: Five cards of clubs arranged in an order

The pseudo code carries elements that are quite akin to those in C, and the alphabets used for each iteration are conventional ones. The character 'j' indicates the 'current card' that is picked up and the ' ' sign symbolises that the remainder of the line is a

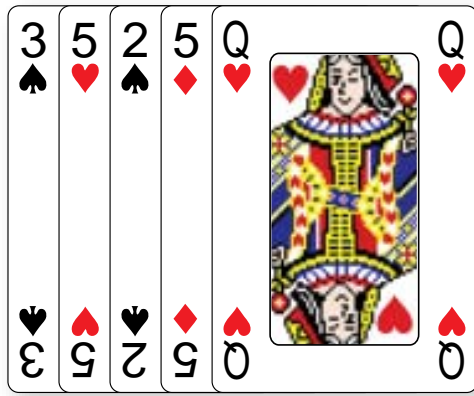


Figure 2: A set of cards from different families

comment. The numbers that we wish to sort are represented as the key-select. By looking at the algorithm, you can see that the parameters are passed to a procedure by value.

As the algorithm is quite simple, it is self-explanatory. Now try to expand the same algorithm to another problem shown in Figure 2. If you have understood the first one, this will be quite simple, except that you need to bring in some additional rules as there are cards from different families and two cards here have the same value (of hearts and diamonds).

Analysing an algorithm has come to mean predicting the resources that the algorithm requires so as to get the desired output. It considers aspects like memory allocation, communication bandwidth, computer hardware, etc. We also need to take into account parameters like computational time when it comes to the practical side. These parameters may, in turn, depend on *input size* and the *running time*.

## Methodology: the divide-and-conquer approach

This is an effective methodology that we can adopt when we design algorithms. It involves:

- Divide: Divide the given sequence (with  $n$  elements) into two sub-sequences (of  $n/2$  elements each)
- Conquer: Sort the two new sub-sequences recursively using the merge sort algorithm.
- Combine: Merge the two sorted sub-sequences to produce the desired result.

The merge mode is illustrated below:

**MERGE(A, p, q, r)**

**MERGE-SORT (A, p, r)**

if  $p < r$       ▷ To check for base case

then  $q < (p + r)/2$       ▷ For dividing

**MERGE-SORT (A, p, q)**      ▷ Conquering

**MERGE-SORT (A, q + 1, r)** ▷ Conquering

**MERGE (A, p, q, r)**      ▷ Combining

The above pseudo code may not enlighten novice programmers, who can look at the expanded code given below and then use the above example to assimilate the core idea:

## Some fields that rely on algorithms

Writing algorithms is not just the headache of programmers alone. There are various other fields in which we need to rely on the algorithmic approach:

- The Human Genome Project has the goal of identifying all the 100,000 genes in the human DNA. It has to determine about three billion sequences of the chemical base pairs! This is virtually impossible unless we employ effective algorithms for pattern recognition and identification.
- Today we depend a lot on electronic commerce for the purchase of any commodity. A good system should have the ability to keep information (such as credit card numbers, passwords and bank statements) secure and encrypted. Algorithms are used for these cryptographic processes.
- Other branches like physical science (see the box on 'Simulation building in physical science) require the use of algorithms for solving complex problems.
- Even a manufacturing industry (or any other commercial setting) needs algorithms for allocating scarce resources.

	1 Sec	1 Min	1 Hr	1 Day	1	1 Year
$n!$						
$n^2$						
$\ln(n)$						
$\log(n)$						
$n \times \ln(n)$						
$2^n$						

Table 1

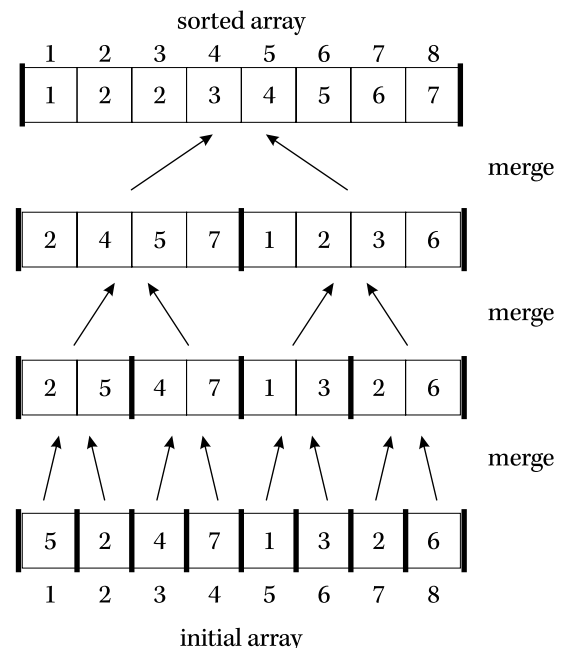


Figure 3: Sorting and arranging an array of values in numbers

**MERGE (A, p, q, r)**

$s1 \leftarrow q - p + 1$

$s2 \leftarrow r - q$



## SIMULATION BUILDING IN PHYSICAL SCIENCE

**S**olid-state physics largely employs simulation techniques for modelling. By taking data from experiments, crystal lattice structures can be constructed easily.

Figure 7 shows one such three-dimensional array of lattice points. The properties of the crystal structure can be inferred by building them. Simulations will give us a clear picture of the crystal properties by considering its primitives.

So is the case with complex bodies. It is found that Jupiter is accompanied, in its orbit, by two groups of asteroids that precede it and follow it at an angular distance of  $\pi/3$  (see Figure 8). By building simulations we can show that these are positions of stable equilibrium. A Runge-Kutta procedure with automatic step control can be used for analysing the data from Table 2.

**Data for analysing a Runge-Kutta procedure with automatic step control**

	Sun	Jupiter	Trojan 1	Trojan 2
Mass	1	0.001	0	0
x	0	0	-4.50333	4.50333
y	0	5.2	2.6	2.6
z	0	0	0	0
$V_x$	0	-2.75674	-1.37837	-1.37837
$V_y$	0	0	-2.38741	2.38741
$V_z$	0	0	0	0

Table 2

Using the computational procedure we can get a prediction as shown in Figure 9.

You can also try solving simple problems of the following form:

$$\frac{d^2x}{dy^2} = F \left( x, y, \frac{dy}{dx} \right)$$

The Runge-Kutta procedure is quite sufficient to handle these types of problems, provided you have enough data.

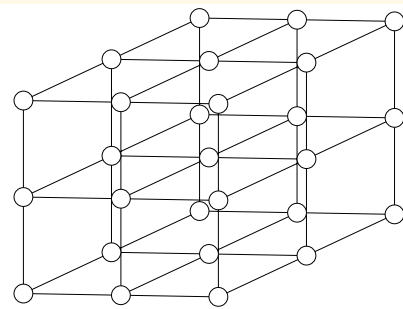


Figure 7: A 3D array of lattice points

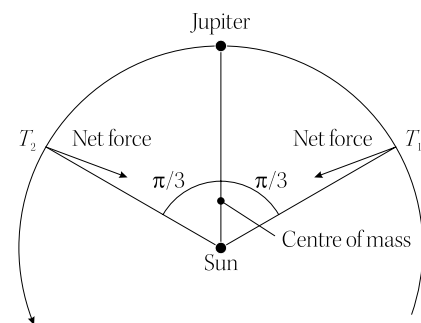


Figure 8: Jupiter is accompanied by two groups of asteroids that precede and follow it at an angular distance of  $\pi/3$

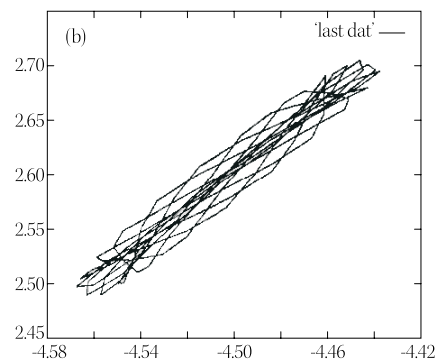


Figure 9: This prediction can be made using computational procedures

```
make arrays L[1 .... s1 + 1] and R[1 .... s2 + 1]
```

```
for i ← 1 to s1
```

```
do L[i] ← A[p + i - 1]
```

```
for j ← 1 to s2
```

```
do R[j] ← A[q + j]
```

```
L[s1 + 1] ← ∞
```

```
R[s2 + 1] ← ∞
```

```
i ← 1
```

```
j ← 1
```

```
for k ← p to r
```

```
do if L[i] ≤ R[j]
```

```
then A[k] ← L[i]
```

```
i ← i + 1
```

```
else A[k] ← R[j]
```

```
j ← j + 1
```

Let's look at an example to comprehend the idea better. I found the following problem in a book that deals with problem solving. A part of the problem involves arranging an array of values [5, 2, 4, 7, 1, 3, 2, 6]. This will be our initial (given) array. Now, we can use our methodology to solve the problem. Figure 3 shows the consecutive division and merging processes.

We can imagine the process in many different ways. If the set is random, then we could have another array with the same elements in a different order. The solution is shown in Figures 4, 5 and 6. Here, Figures 4 and 5 represent the initial steps and Figure 6 represents the final output. It should be noted that the intermediate stages are not shown here, as they are similar steps that can be envisaged in one's mind. The step-by-step procedure will also throw ample light on the subs L and R that are created.

Once you are done with simple algorithms, you can apply the same 'black box representation' idea (that you employ while writing

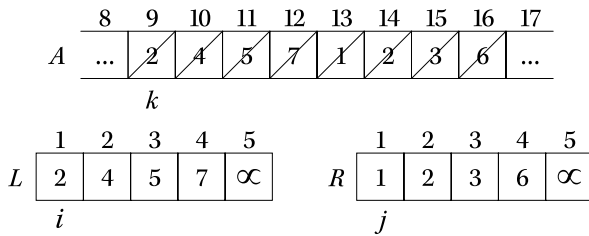


Figure 4: Initial steps of sorting the array

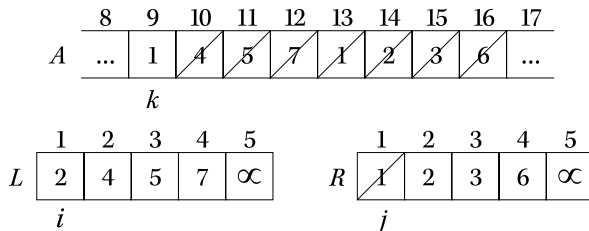


Figure 5: Initial steps of sorting the array

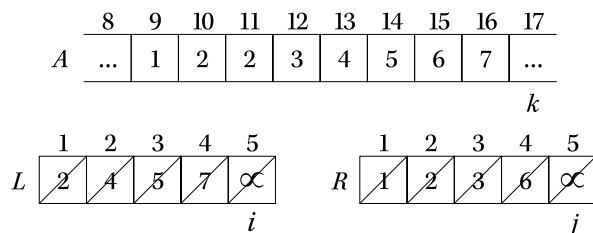


Figure 6: The final output

programs) and use the simple algorithms as sub-routine calls in your main algorithm (depending on the model you opt for).

Now we can look at another simple algorithm that can handle errors. The following code shows the multiplication of matrices:

```
MATRIX-MULTIPLICATION(A, B)
if columns[A] ≠ rows[B]
    then error "This operation is not allowed"
else for i ← 1 to rows[A]
    do for j ← 1 to columns[B]
        do C[i, j] ← 0
        for p ← 1 to columns[A]
            do C[i, j] ← C[i, j] + A[i, p] · B[p, j]
return C
```

Before we move on to the complex stuff, you can test yourself by considering the following problem (Table 1). You are required to find out the maximum value of  $n$  that corresponds to each of the stipulated times. The data provided along with it is that you have  $f(n)$  in milliseconds. Try solving it!

We can see that the style remains the same when we try to write algorithms in C. If we need to compare functions for a pointer to an integer, we can have the following:

```
#include "compare.h"

int int_is_equal(void *vplace1, void *vplace2)
{
    int *place1;
```

```
    int *place2;

    place1 = (int *) vplace1;
    place2 = (int *) vplace2;

    return *place1 == *place2;
}

int int_is_compare(void *vplace1, void *vplace2)
{
    int *place1;
    int *place2;

    place1 = (int *) vplace1;
    place2 = (int *) vplace2;

    if (*place1 < *place2) {
        return -1;
    } else if (*place1 > *place2) {
        return 1;
    } else {
        return 0;
    }
}
```

You may find a reference to a header file in the program. So you need *compare.h* along with it to get the desired result:

```
#ifndef ALGORITHM_COMPARE_INT_H
#define ALGORITHM_COMPARE_INT_H


#ifdef __cplusplus
extern "C" {
#endif

int int_is_equal(void *place1, void *place2);

int int_is_compare(void *place1, void *place2);

#ifdef __cplusplus
}
#endif

#endif
```

There could be problems that belong to the *NP-complete* category. These problems may not have an exact solution. We will be discussing these aspects once we are done with topics like asymptotic notations and complex algorithms. 

**By: Aasis Vinayak PG**

The author is a hacker and a free software activist who does programming in the open source domain. He is the developer of V-language—a programming language that employs AI and ANN. His research work/publications are available at [www.aasisvinayak.com](http://www.aasisvinayak.com)



## Package management tips

To check whether a package is present in the repositories or to check the version and size of the software, open the terminal and enter in root mode. After that, perform the following commands, depending on your distro:

- Debian/Ubuntu: `aptitude search <package_name>`
- Mandriva: `urpmq <package_name>`
- Fedora: `yum list <package_name>`
- openSUSE: `zypper search<package_name>`
- Sabayon: `equo match <package_name>`
- Arch Linux: `pacman -Ss <package_name>`

To know the number and name of packages installed, use the following commands based on your distro:

- Debian/Ubuntu: `dpkg -l`
- Mandriva/Fedora/openSUSE: `rpm -qa`
- Sabayon: `equo list`
- Arch Linux: `pacman -Q`

To list the repositories activated/installed, use the following commands:

- Debian/Ubuntu: `cat /etc/apt/sources.list`
- Mandriva: `urpmq --list-media`
- Fedora: `yum repolist`
- openSUSE: `zypper repos`
- Sabayon: `equo repoinfo`
- Arch Linux: `cat /etc/pacman.conf`

Please note that you need to use the `sudo` or `su` command to gain root privileges.

—Shashwat Pant, [shashwat.pant@gmail.com](mailto:shashwat.pant@gmail.com)

## Simple VIM tricks

While in `vi` editor, you can configure some items on-the-fly such as line numbers.

- `:set number`—causes line numbers to be displayed
- `:set nonumber`—to turn off the line numbers
- `:set ignorecase`—causes searches to be case insensitive

- `:help`—to list other such commands

—Vivek, [wizardvivek@gmail.com](mailto:wizardvivek@gmail.com)

## To spell-check in a `vi` editor

To do a spell-check without leaving a `vi` session, try the following key sequence inside `vi`:

```
:w !spell -b
```

This will give you the list of words that are misspelled.

—Shabeer V V, [shabeer.vv@hotmail.com](mailto:shabeer.vv@hotmail.com)

## Delete files older than 'x' days

The `find` utility allows you to pass in a bunch of interesting arguments, including one to execute another command on each file. We'll use this in order to figure out what files are older than a certain number of days, and then use the `rm` command to delete them. The command syntax is as follows:

```
find /path/to/files* -mtime +5 -exec rm {} \;
```

You can always list the files and check before deleting anything, by running the following command:

```
find /path/to/files* -mtime +5 -exec ls {} \;
```

Note that there are spaces between `rm`, `{}`, and `;`

In the above command, the first argument is the path to the files. `-mtime` is used to specify how many days old the file is. If you enter `+5`, it will find files older than five days. `-exec` allows you to pass in a command such as `rm`. The `{}` at the end is required to end the command.

—Remin Raphael, [remin13@gmail.com](mailto:remin13@gmail.com)



## Automate *fsck* on all partitions

At start-up, I mount several other partitions automatically using *fstab*, and on those, after *foo* number of mounts, get a warning that the drive should be checked. However, it's a pain in the neck to switch to Runlevel 1 and manually check all those partitions.

Why should I have to do that manually? Why can't I set my system check the filesystem at startup as it does for the root partition?

You can do this by editing a few lines in the */etc/fstab* file. You need to define *fsck-pass* entry in */etc/fstab*.

For example, in my */etc/fstab* file, I have:

```
# /etc/fstab: static file system information.
#
/dev/sda1    /          ext2      defaults 1      1
/dev/sda2    none       swap      sw        0      0
/dev/sda3    none       swap      sw        0      0
proc         /proc      proc      defaults 0      0
/dev/sda5    /usr       ext2      rw        1      2
/dev/sda6    /tmp       ext2      rw        1      2
/dev/sda7    /export/home/fuzzy ext2      rw        1      2
```

Notice that my last three filesystems are marked "pass 2", which means that they will get checked second, that is, after the root filesystem. Make sure you don't have a zero "0" in the "pass" column of your filesystem(s) for which you want *fsck* to be done automatically.

*swap* and *proc* never get checked for obvious reasons.

—Amit N. Bhakay, amit.nb@gmail.com

## Running additional programs at boot time

The */etc/rc.d/rc.local* script is executed by the *init* command at boot time or when changing runlevels. Adding commands to this script is an easy way to perform necessary tasks at boot time, like starting special services or initialising devices without writing complex initialisation scripts in the */etc/rc.d/init.d/* directory and creating symbolic links.

The following is an example of how to add symbolic links to services:

```
S90spamassassin -> ../init.d/spamassassin
```

Usually, the number following *S* should be in the 90s to ensure that the supporting processes for this have already been started by *init*. You can also add your own scripts here so that they will run at boot time.

—Oracle, craigc99@gmail.com

## Opening different Linux terminals through Putty

*screen* is a program that allows you to 'detach' from a running process/program, leave it running, and 'attach' from another computer or terminal—all without losing any work. Here is what you need to do—start the *screen* program:

```
screen
```

Now run a command and detach the screen. To detach, type *Ctrl+A+D*. To re-attach from some other computer, log in and issue the following command:

```
screen -x
```

*screen* allows you to work collaboratively on a console—every connected person can type or watch the others typing. You can teach others or even give support remotely.

Start *screen*. Tell your partner to 'attach' using the command:

```
screen -x
```

To make a log of your session to a plain-text file, type *Ctrl+A+H*. If you want to attach (*screen -x*) and there are multiple screen sessions available, the program will then list the available screen sessions. The following is a typical output:

```
There are screens on:
```

```
2463.pts-2.atreus      (Attached)
11068.lab              (Attached)
```

In this case, the user can explicitly specify the desired session using an unambiguous substring of the session name. In the above example, *screen -x 11068* and *screen -x lab* are equivalent, and both users will now share the same session.

Use of *screen* can be controlled while it is running by prefacing commands with the command-key character. By default, this is *Control+A*. For instance, to view the help screen, enter *Ctrl+A ?*. The detach command is *Control+A Control+D*. *Control+A Control+C* creates a new terminal screen. *Control+A* shows a list of terminal screens *Control+A N* switches to the next screen.

--Ajeet S Raina, ajeet.singh.raina@logica.com

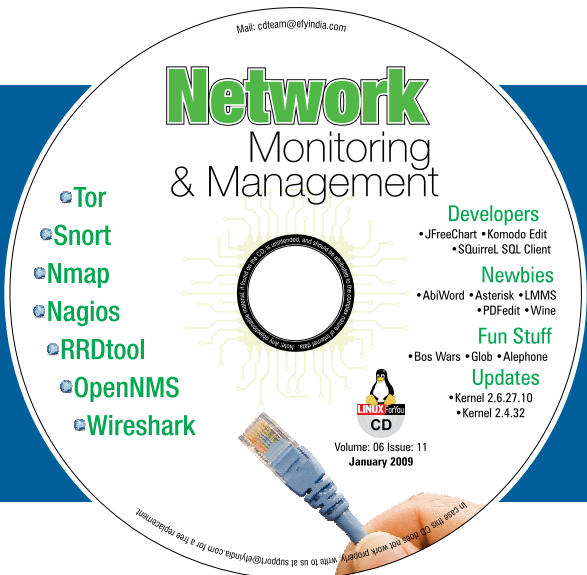


## Share Your Linux Recipes!

The joy of using Linux is in finding ways to get around problems—take them head on, defeat them! We invite you to share your tips and tricks with us for publication in LFY so that they can reach a wider audience. Your tips could be related to administration, programming, troubleshooting or general tweaking. Submit them at <http://www.linuxforu.com>

The sender of each published tip will get an LFY T-shirt.

# Essential Networking Tools



This month's CD packs in a variety of network tools that you can try out, and which may help you with your network admin workload

Network management, monitoring and security are some of the additional workload you get stuck with when you're in charge of a network. This month's *LFY* CD has a few tools that may come in handy.

**Nmap**, or the Network Mapper, is a utility for network exploration or security auditing. It is useful for tasks such as network inventory, managing service upgrade schedules, and monitoring host or service uptime. Nmap uses raw IP packets to determine what hosts are available on the network, the services (application name and version) those hosts are offering, the operating systems (and OS versions) they are running, the type of packet filters/firewalls in use, and dozens of other characteristics. It was designed to rapidly scan large networks, but works fine against single hosts. Nmap runs on all major computer operating systems, and both console and graphical versions are available.

</software/powerusers/nmap>

**OpenNMS** is the world's first enterprise-grade network management platform. OpenNMS focuses on three main areas: *Service Polling* that determines service availability and

reporting on it; *Data Collection* that collects, stores and reports network information as well as generates thresholds; and *Event and Notification Management* that is responsible for receiving events, both internal and external, and using those events to feed a robust notification system, including escalation.

</software/powerusers/opennms>

**RRDtool**, or the Round Robin Database tool, is an industry-standard, high-performance data logging and graphing system for time series data. It can be used to write your custom monitoring shell scripts or create whole applications using its Perl, Python, Ruby, TCL or PHP bindings.

</software/powerusers/rrdtool>

**Nagios** is an enterprise-class network monitoring tool. It allows you to gain insight into your network and fix problems before users know they even exist. It's stable, scalable, supported, and extensible. Most importantly, it works!

</software/powerusers/nagios>

**Snort** is a network intrusion prevention system, capable of performing real-time traffic analysis and packet logging on IP networks. It can perform

protocol analysis, content searching/matching and can be used to detect a variety of attacks and probes, such as buffer overflows, stealth port scans, CGI attacks, SMB probes, OS fingerprinting attempts, and much more.

Snort uses a flexible rules language to describe traffic that it should collect or pass, as well as a detection engine that utilises a modular plug-in architecture. Snort has a real-time alerting capability as well, incorporating alerting mechanisms for syslog, a user specified file, a UNIX socket, or WinPopup messages to Windows clients using Samba's smbclient.

Snort has three primary uses: it can be used as a straight packet sniffer like *tcpdump*, a packet logger (useful for network traffic debugging, etc), or as a full-blown network intrusion prevention system.

</software/powerusers/snort>

**Tor** is a network of virtual tunnels that allows people and groups to improve their privacy and security on the Internet. The aim of Tor is to improve your privacy by sending your traffic through a series of proxies. Your communication is encrypted in multiple layers and routed via multiple hops through the Tor network to the final receiver. Tor works with many of your existing applications, including

Web browsers, instant messaging clients, remote login, and other applications based on the TCP protocol.

</software/powerusers/tor>

**Wireshark** is a protocol analyser. It has a rich feature set that includes deep inspection of hundreds of protocols with more being added all the time, live capture and offline analysis, and comes with a standard three-pane packet browser. It runs on most popular operating systems.

</software/powerusers/wireshark>

**Cacti** is a complete network graphing solution designed to harness the power of RRDTool's data storage and graphing functionality. Cacti provides a fast poller, advanced graph templating, multiple data acquisition methods, and user management features out-of-the-box. All of this is wrapped in an intuitive, easy-to-use interface that makes sense for LAN-sized installations up to complex networks with hundreds of devices.

</software/powerusers/cacti>

**OpenVAS** stands for Open Vulnerability Assessment System and is a network security scanner with associated tools like a graphical user front-end. The core component is a server with a set of network vulnerability tests (NVTs) to detect security problems in remote systems and applications.

</software/powerusers/opensvas>

## For developers

**JFreeChart** is a 100 per cent Java chart library that makes it easy for developers to display professional quality charts in their applications. JFreeChart's extensive feature set includes: a consistent and well-documented API, supporting a wide range of chart types, a flexible design that is easy to extend and targets both server-side and client-side applications, with support for many output types, including Swing components, image files (including PNG and JPEG), and vector graphics file formats (including PDF, EPS and SVG).

</software/developers/jfreechart>

**Komodo Edit** is a multi-language editor. It is a dynamic language

expertise for Perl, PHP, Python, Ruby, and Tcl, plus JavaScript, CSS, HTML and XML, and template languages like RHTML, Template-Toolkit, HTML-Smarty and Django.

[/software/developers/komodo\\_edit](/software/developers/komodo_edit)

**Squirrel SQL Client** is a graphical Java program that will allow you to view the structure of a JDBC compliant database, browse the data in tables, issue SQL commands, etc.

[/software/developers/squirrel\\_sqlclient](/software/developers/squirrel_sqlclient)

## For you and me

**AbiWord** is a very lightweight word processing program, which is suitable for a wide variety of word processing tasks.

</software/newbies/abiword>

**Asterisk** is the world's leading open source telephony engine and tool kit. Offering flexibility unheard of in the world of proprietary communications, it empowers developers and integrators to create advanced communication solutions for free.

</software/newbies/asterisk>

**LMMS** is a cross-platform alternative to commercial programs like FL Studio, which allow you to produce music with your computer. This includes the creation of melodies and beats, the synthesis and mixing of sounds, and arranging of samples. You can have fun with your MIDI-keyboard and much more, all in a user-friendly and modern interface.

</software/newbies/lmms>

**PDFedit** is an editor to manipulate PDF documents offering both GUI and command line interfaces. Scripting is used to a great extent in an editor, and almost anything can be scripted. It is also possible to create your own scripts or plug-ins.

</software/newbies/pdfedit>

**Wine** is a translation layer (a program loader) capable of running Windows applications on Linux and other POSIX-compatible operating systems. Windows programs running in Wine act as native

programs would, running without the performance or memory usage penalties of an emulator, with a look and feel similar to other applications on your desktop.

</software/newbies/wine>

## Some fun stuff

**Aleph One** is an open source descendant of Bungie's Marathon 2 first-person 3D shooting game. Aleph One features software and OpenGL rendering, Internet play, Lua scripting, and much more.

</software/funstuff/alephone>

**Globulation 2** is an innovative real-time strategy (RTS) game that reduces micro-management by automatically assigning tasks to units. The player chooses the number of units to assign to various tasks, and the units do their best to satisfy the requests. This allows players to manage more units and focus on strategy rather than on micro-management.

Globulation 2 also features AI, allowing single-player games or any possible combination of human-computer teams. The game also includes a scripting language for versatile gameplay or tutorials and an integrated map editor. You can play Globulation 2 in single player mode, through your local network, or over the Internet with Ysagoon Online Gaming.

</software/funstuff/glob2>

**Bos Wars** is a futuristic RTS game, in which players have to combat their enemies while developing their war economy. The trick is to balance the effort put into building their economy and building an army to defend and attack the enemies. Energy is produced by power plants and from magma that gets pumped from hot spots. Buildings and mobile units are also put up at a continuous rate. Control of larger parts of the map creates the potential to increase your economy throughput. Holding key points like roads and passages allows for different strategies. It is possible to play with other players over a LAN and the Internet, or play against the computer.

</software/funstuff/boswars>





# Virtual Microsoft

Microsoft has been talking a lot about interoperability for a few years now. What is the company doing with respect to interoperability on the virtualisation front? The LFY Bureau caught up with Radhesh Balakrishnan, director of virtualisation, Microsoft, to understand what's happening.

## Q How would you define interoperability on the virtualisation front?

Microsoft is committed to enable and support interoperability with non-Windows operating systems. We take a multi-faceted approach to the interoperability of virtualisation software. First, we've worked on customer-driven industry collaborations, such as our agreements with Citrix (XenSource), Novell and Sun.

Second, we work with the vendor community to establish standards that promote common technologies, such as device virtualisation through the PCI-SIG and Open Virtual machine Format (OVF) through the DMTF.

Third, we proactively licence Microsoft intellectual property for broader use, such as extending the Open Specification Promise (OSP) to Microsoft's Virtual Hard Disk format and the hypercall API of Windows Server 2008 Hyper-V.

Fourth, we've created technologies that bridge different systems, such as virtual machines add-ins and integration components for Linux.

## Q When it is said that Novell SUSE Linux Enterprise Systems support Windows guests on Xen, does it work as a full-virtualisation solution by emulation, or paravirtualisation solution (which is really the main advantage of Xen)?

It works via paravirtualisation. We've worked with Novell to enable the best performance possible when customers run Windows Server on Novell SLES/Xen and SLES on Windows Server 2008 Hyper-V.

## Q It's apparent that customers running a mixed Linux-Windows environment don't only run SLES. Are you

## working with other vendors as well?

Microsoft and Red Hat both realise the importance of virtualisation and the interoperability needs of our joint customers, and we are actively discussing how to support Red Hat Enterprise Linux on Hyper-V.


## Q How does Hyper-V match up to other proprietary solutions, say, VMware Workstation or ESX?

Windows Server 2008 Hyper-V is comparable or better than VMware ESX in terms of scalability, performance, security, networking, I/O throughput, interoperability and technical support.

## Q Recently, at VM World, VMware announced its 'VDC OS', which seems to extend the use of virtualisation beyond the server. The target is definitely Microsoft, which is emerging as a competitor to VMware with Hyper V. What do you have to say about that?

Hyper-V isn't designed to target VMware, but rather provide enterprise, small and medium businesses with a cost-effective and easier-to-use virtualisation platform. Customers are adopting Windows Server 2008 for not just virtualisation but also for advanced Web, networking, identity and security infrastructure, which are capabilities not provided by VMware.

## Q While announcing this VDC OS, VMware CEO and president, Paul Maritz also said: "The traditional operating system has all but disappeared." How much do you agree with that statement?

We don't agree. Virtualisation is part of the operating system. Customer and partner adoption prove that. **END** 



# FOSS Yellow Pages

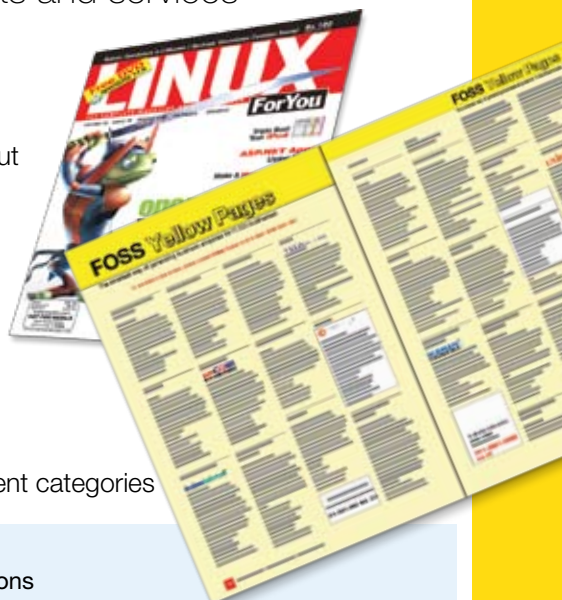
The best place for you to buy and sell FOSS products and services

## HIGHLIGHTS

- A cost-effective marketing tool
- A user-friendly format for customers to contact you
- A dedicated section with yellow back-ground, and hence will stand out
- Reaches to tech-savvy IT implementers and software developers
- 80% of LFY readers are either decision influencers or decision takers
- Discounts for listing under multiple categories
- Discounts for booking multiple issues

## FEATURES

- Listing is categorised on the basis of products and services
- Complete contact details plus 30-word description of organisation
- Option to print the LOGO of the organisation too (extra cost)
- Option to change the organisation description for listings under different categories



## TARIFF

### Category Listing

ONE Category .....	Rs 2,000
TWO Categories.....	Rs 3,500
THREE Categories.....	Rs 4,750
ADDITIONAL Category .....	Rs 1,000

### Value-add Options

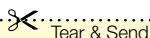
LOGO-plus-Entry.....	Rs 500
Highlight Entry (white background).....	Rs 1,000
Per EXTRA word (beyond 30 words).....	Rs 50

## KEY POINTS

- Above rates are per-category basis.
- Above rates are charges for publishing in a single issue of LFY.
- Max. No. of Words for Organisation Description: 30 words.

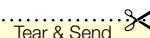
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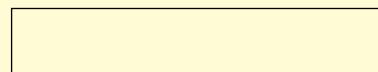
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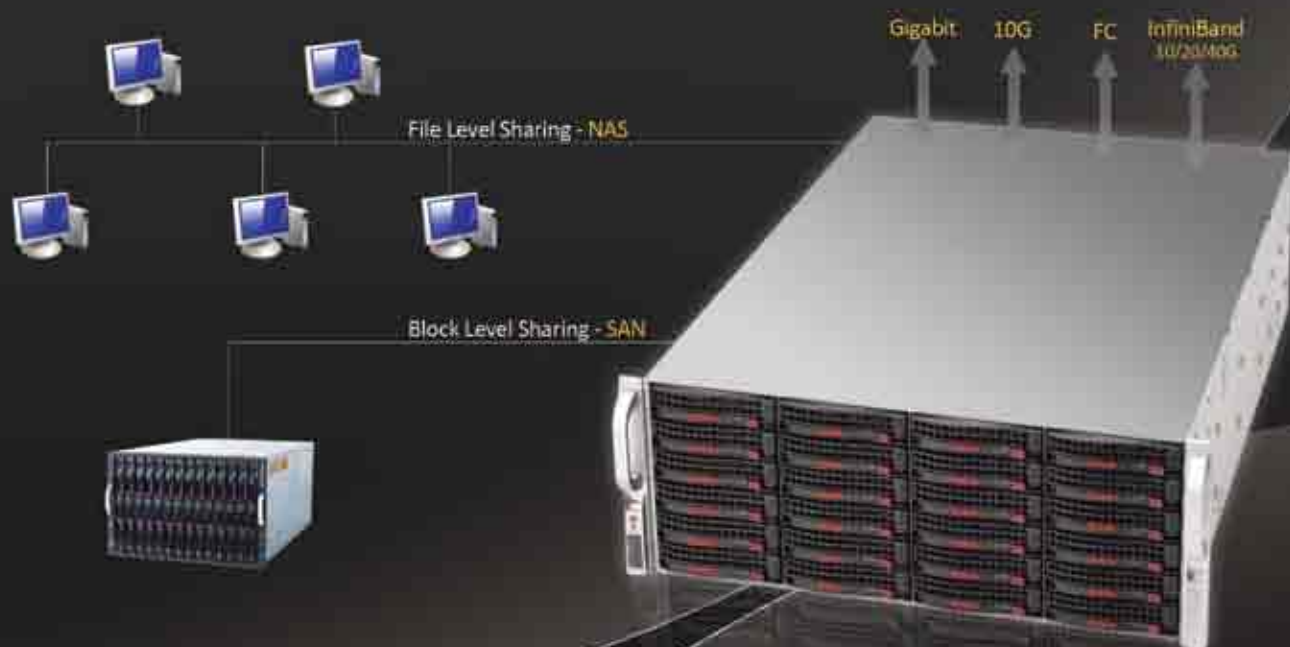
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